# I-95/I-395 Transit/TDM Study
# Final Report

**FEBRUARY 29, 2008**

**Developed by**
**I-95/I-395 Transit/TDM Technical Advisory Committee**

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# Acknowledgements

In early 2007, at the request of the regional transportation agencies and authorities, the Secretary of Transportation of the Commonwealth of Virginia asked the Department of Rail and Public Transportation (DRPT) to initiate a study and form a multijurisdictional Technical Advisory Committee to provide technical input into determining the appropriate transit services to be implemented in conjunction with the I-95/I-395 HOV/Bus/HOT Lane project.

The Technical Advisory Committee members extensively reviewed and discussed the recommendations of this study. In preparing the recommendations, the TAC reviewed the scope, inputs, demand modeling, and results of the study at every stage. The committee members who represent the interested jurisdictions and agencies agreed with the final recommendations of the study. The committee members include:

- Jim Maslanka of City of Alexandria;
- Tamara Ashby and Lynn Rivers of Arlington County;
- Randall White and Jaak Pedak of Fairfax County;
- Kathleen Beck of Fredericksburg Regional Transit (FRED);
- Lloyd Robinson and Diana Utz of the George Washington Regional Commission (GWRC)/ Fredericksburg Area Metropolitan Planning Organization (FAMPO);
- Don McAuslan of the Metropolitan Washington Council of Governments (MWCOG);
- Rick Taube of the Northern Virginia Transportation Commission (NVTC);
- Alfred Harf and Eric Marx of the Potomac and Rappahannock Transportation Commission (PRTC);
- Sara Woolfenden and Fulton deLamorton of Stafford County;
- Phyllis Kaplan of the U.S. Department of Defense;
- Christine Hoeffner of Virginia Railway Express (VRE); and
- Wendy Jia and Fred Simms of the Washington Metropolitan Area Transit Authority (WMATA).

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# Executive Summary

# Executive Summary

The purpose of the I-95/I-395 Transit/Transportation Demand Management[1] (TDM) Study was to determine the most effective investments that could be made in transit and TDM within the I-95/I-395 Corridor using funding proposed to be available through the I-95/I-395 High-Occupancy Vehicle (HOV)/Bus/High-Occupancy Toll (HOT) Lanes project. The proposed funding is above and beyond improvements already included in the scope of the I-95/I-395 HOV/Bus/HOT Lanes project that will benefit transit and TDM.

The study was conducted by the I-95/I-395 Transit/TDM Technical Advisory Committee (TAC) consisting of members from Federal, state and local jurisdictions, transit agencies, and transportation demand management providers in cooperation with the Virginia Department of Rail and Public Transportation (DRPT). This multimodal transportation planning effort utilized the results of a market research survey, travel demand forecasting, park-and-ride demand forecasting, and transportation demand management modeling, as well as the expertise of the TAC to develop and evaluate alternative program investments. The study includes a fiscally constrained recommendation that includes planning-level cost estimates and identification of entities potentially responsible for implementation and operation of the services/improvements identified.

The Commonwealth Transportation Board will be responsible for allocating revenues that become available through the I-95/I-395 HOV/Bus/HOT Lanes project for transit and transportation demand management improvements. The recommendation of the I-95/I-395 Transit/TDM Study represents an initial planning effort with the understanding that additional analysis and coordination with service providers will be needed prior to the expenditure of any funds.

## *Background*

The I-95/I-395 Transit/TDM Study was completed in coordination with the work being done on the I-95/I-395 HOV/Bus/HOT Lanes project proposed by Fluor-Transurban under the Public-Private Transportation Act (PPTA) with the Virginia Department of Transportation (VDOT). The proposed I-95/I-395 HOV/Bus/HOT Lanes project scope includes significant benefits for transit, including:

- 28-mile southern extension of existing HOV lanes;
- 3,000 new park-and-ride spaces in the corridor;
- 33 new entry/exit ramp facilities; and
- In-line Bus Rapid Transit (BRT) station in Lorton.

Above and beyond these improvements, an additional $195 million dollars is projected by Fluor-Transurban to be available from the project for additional transit/TDM improvements. This $195 million, plus the fare recovery for the proposed services, and a small federal contribution represent the dollars assumed to be available for the fiscally constrained Transit/TDM recommendation proposed in this study.

[1] Transportation Demand Management is the application of strategies and programs to change travel behavior in order to reduce the demand on highways and to optimize the performance of the transportation system (e.g., carpooling, vanpooling, park-and-ride facilities, guaranteed ride home programs, and shared-ride benefits and support programs).

### Study Area

The study area is comprised of an area 56-miles in length and approximately five miles on either side of the corridor defined by I-95/I-395 from U.S. 1 and I-95 near Massaponax in the south to the Potomac River in the north. The Metropolitan Washington Council of Governments (MWCOG) model region was used for travel forecasting analysis. Figure ES-1 shows the general vicinity and extents of the study corridor and area. Key destinations in the study area were identified to be Washington D.C. (core and noncore), Pentagon/Pentagon City/Crystal City, Shirlington, Mark Center/Skyline, Tyson's Corner, Merrifield, Alexandria, Fort Belvior/EPG/Springfield, Woodbridge, Quantico, and Garrisonville-Aquia.

## *Existing Transit/TDM Service*

The I-95/I-395 Corridor currently has a very high level of transit and HOV usage. For example, during the morning peak period, there are over 127 buses operating per hour on the Corridor in the vicinity of King Street in Alexandria and about 17 buses operating per hour in the Corridor in the vicinity of Fredericksburg. There are 10 WMATA Metrorail trains per hour, 2 VRE trains every hour, and 2 Amtrak trains in the morning peak period servicing the study corridor. A variety of TDM programs and services currently operate in the study corridor, including over 500 vanpools, 21 park-and-ride lots, 19 slug locations, and 5 Rideshare/Employer Outreach Programs.

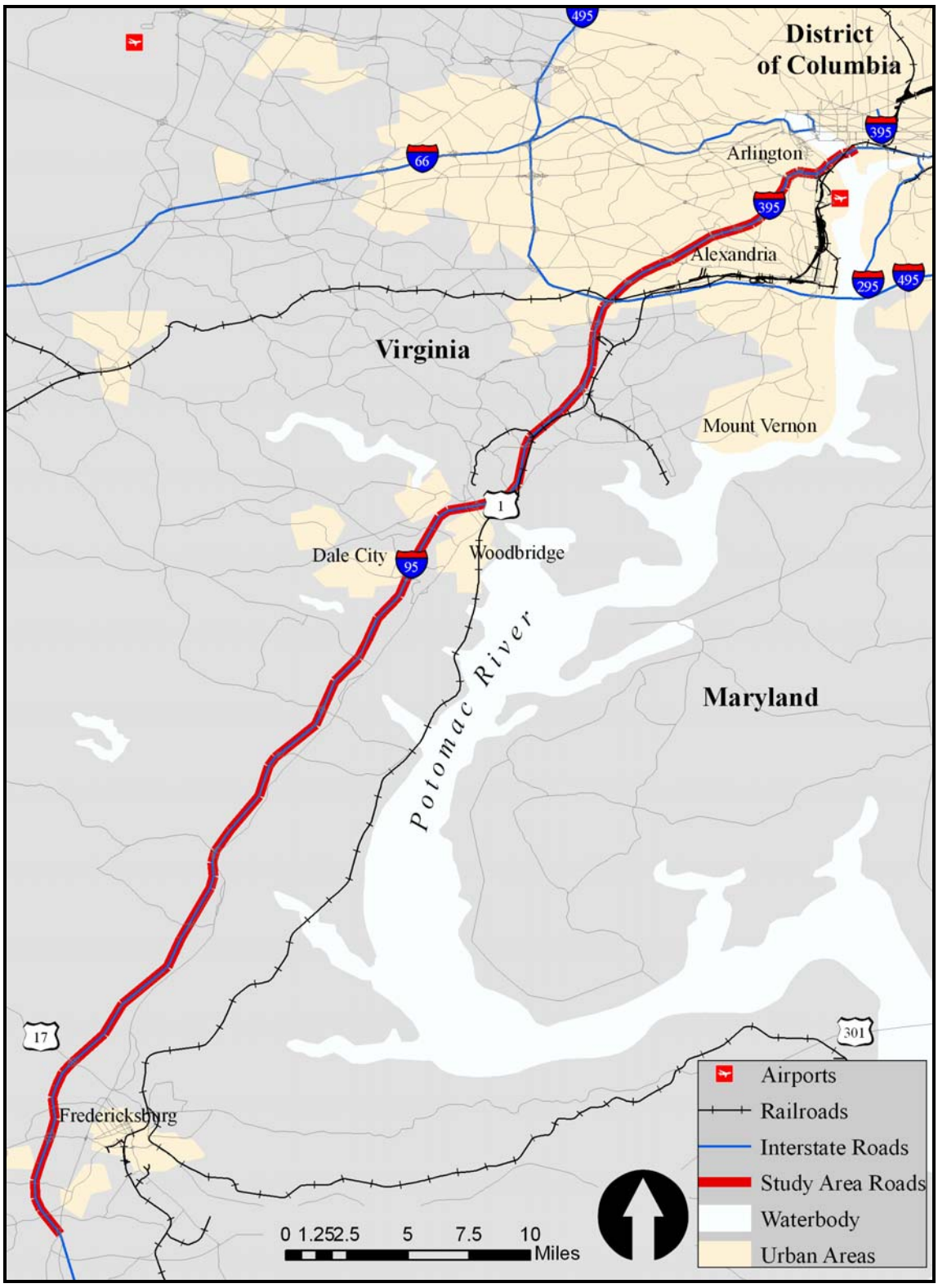
## *Public Outreach and Market Research*

As an integral part of the study process, a public information program was conducted jointly with VDOT. Presentation boards, slides, handouts, and web site materials were developed for the purpose of informing interested citizens about the study process and to solicit input for use in the study. In-person meetings were conducted on five dates in July in five separate locations across the entire study area: Arlington, Fairfax, Prince William, Fredericksburg, and Spotsylvania. All materials from the meetings were posted to the Internet to extend the potential reach.

A market research survey also was conducted as part of the outreach effort from this study. The market research was used to determine current travel patterns by mode in the study corridor and to explore expected changes in travel behavior as a result of the construction and operation of the HOT lanes project. The survey also was used to identify the relative appeal of specific enhancements and programs needed to be in place to increase the likelihood of using alternatives to the single occupancy vehicle mode and to assess the relative impact of the alternatives to help calibrate subsequent modeling activities. Postcard invitations were mailed to some 75,000 households and direct e-mail lists with thousands of additional contacts were used to reach other potential participants. Some 3,300 respondents provided information on their current behavior, attitudes, and preferences.

The market survey analysis showed that awareness of the HOT lanes is high among commuters in the corridor. Nearly all sluggers (94 percent) are aware of the HOT lanes versus 75 percent of single occupant vehicle (SOV) users. Sluggers are especially likely (71 percent) to believe that HOT lanes will discourage drivers from picking up sluggers. However, most transit and HOV commuters say that they would not change their commute method with the introduction of the new option of paying to use the HOT lanes (i.e., 53 percent of SOV; 95 percent of vanpoolers; 81 percent of carpoolers; 91 percent of bus riders; 82 percent of sluggers; and 86 percent of train riders). Most potential HOT lane users would be drawn from existing general purpose lane low-occupancy vehicle users. The likelihood of using HOT lanes is highest among commuters from Spotsylvania, Stafford, and Prince William Counties.

**Figure ES-1. Vicinity and Extents of the Study Corridor**



## *Study Alternatives*

The development of alternatives was a detailed process that involved substantial coordination of and consensus among the TAC members. First, overall guiding objectives were established. Second, key assumptions and propositions were outlined. Third, the specific approach to defining the transit and TDM alternatives was set forward.

The objectives that guided the definition and analysis of the transit/TDM alternatives were as follows:

- Preserve and increase the transit/HOV capacity, use, and operational efficiency in the managed lanes and in the corridor;
- Increase transit level of service through improvement of coverage in higher density areas and service improvements to major activity centers and destinations;
- Preserve transit and HOV ridership while implementing the HOT lanes by providing improvements that help maintain current market share for transit, carpools, and vanpools; and
- Utilize new HOT lane features to attract new transit and HOV riders by using a corridor management approach to improve existing service and serve new markets.

The study team and the TAC suggested over 60 alternatives for testing. The alternatives were combined into three tiers of investment:

- Low ($250 million);
- Medium ($500 million); and
- High (fiscally unconstrained).

With these limits in mind, the set of alternatives were detailed. In particular:

- To further promote carpooling and vanpooling (and slugging), additional TDM actions were proposed;
- New bus transit alternatives were developed to take advantage of the opportunities represented by the introduction of new access/egress points on HOV lanes;
- Existing routes were revised to serve new markets, e.g., through minor changes to route alignments;
- New commuter and express bus services were created, e.g., in the U.S. Route 1 corridor between Alexandria and the Pentagon;
- New local feeder bus services were proposed to connect commuters to VRE/Amtrak/Metrorail or commuter bus;
- New neighborhood circulators/shuttles with commuter bus were developed to provide local bus service to residential neighborhoods and continue as commuter buses to Northern Virginia and Washington, D.C.; and
- Rail extensions and other fixed facilities were considered. Potential projects included the extension of Metrorail to Potomac Mills, BRT along Route 1, enhancements to VRE/Amtrak, and in-line transit stations at major activity centers along the HOT lanes (to allow buses to stop with minimal delay).

The process of developing the tiered transit/TDM alternatives was iterative. Qualitative assessments were performed with the help of TAC members to arrive at decisions in the direction in which to take the alternatives. In addition, public and stakeholder input, market survey analysis,

current and forecast travel demand in the study area, park-and-ride needs analysis were used to develop and evaluate the alternatives.

Through the travel forecasts, the study showed that the 2006 MWCOG Constrained Long-Range Plan (CLRP) already contained significant transit service improvements to the corridor that result in high transit and HOV ridership. HOT lanes generally were not forecast to adversely impact transit or carpool mode share versus existing levels. Moreover, the proposed set of transit/TDM improvements helped to maintain high-transit and shared-ride mode share in the corridor even with the expected significant increases in overall travel in the corridor. The biggest differences found between the tested alternatives (low, medium, and high) were in the competition among transit modes (i.e., commuter bus, Metrorail, and VRE). Ultimately, the strongest performing strategies were combined from the three tiers of alternatives into a Refined Alternative and then further refined by applying financial assumptions to develop the Fiscally Constrained Recommendation.

## *Fiscally Constrained Transit/TDM Recommendation*

The Refined Alternative was used as the basis to develop a fiscally constrained program and recommendation. The fiscally constrained program assumed reasonably available funding that amounts to $298 million. The funding for improvements would come from a combination of sources, including (in 2010 dollars):

- $195 million HOT lanes lump sum;
- $40 million in Federal (U.S DOT discretionary funding);
- *$63 million* in farebox recovery; and
- $298 million total.

The farebox recovery figure was derived from data provided by service providers for the actual services proposed. The revenue dedicated to transit/TDM improvements is subject to final negotiation by VDOT and Fluor-Transurban and allocation by the Commonwealth Transportation Board.

Since the funding available was short of the level required to fund the full Refined Alternative, prioritization and phasing was necessary to develop a Fiscally Constrained Recommendation. Should additional funding become available in the future, additional elements of the Refined Alternative should then be funded.

The recommended investment strategy for the Fiscally Constrained Recommendation calls for prioritizing and phasing the proposed improvements during actual implementation. The framework used for phasing and prioritizing projects was based on identifying and leveraging all reasonably available funding sources for the proposed improvements and protecting currently planned and programmed transit improvements and associated funding resources.

In summary, the TAC's recommendation for the fiscally constrained program includes service modifications, new services, facility improvements, and enhanced and new TDM programs. It is recommended that $137 million be spent on capital improvements and $161 million for operating expenses over a period of 20 years. The resulting Fiscally Constrained Recommendation can be summarized in year 2010 expenditures as shown in Table ES-1.

## Table ES-1. Program Summary of the Fiscally Constrained Recommendation

| Element | Element Cost (Millions) | Total Cost (Millions) |
|---|---|---|
| *Transit Services* | | *$188.9* |
| Bus Service Modifications | $29.6 | |
| New Shuttle Bus | $7.4 | |
| New Bus Services | $130.3 | |
| VRE | $21.6 | |
| *TDM* | | *$20.0* |
| | | |
| *Park-and-Ride Lots* | | *$37.5* |
| | | |
| *Fixed Facilities* | | *$51.8* |
| Metrorail Station Improvements | $5.0 | |
| BRT Stations | $40.0 | |
| Other Transit Centers | $1.5 | |
| VRE Platform Extensions and Yard Facilities (with Longer Trains) | $5.3 | |
| **Grand Total** | | **$298.2** |

The service modifications recommended in the fiscally constrained program include:

- Adding a fifth bus to ART Route 41 on weekdays;
- Increasing frequency on WMATA 7B by adding one bus (reduce headway from 35 minutes to 17 minutes);
- Modifying Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield Metrorail Station during peak hours;
- Improving existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency (adds two additional trips per peak period);
- Increasing frequency on OmniRide North Route 1 by adding three additional trips in each peak period, one in midday and late evening;
- Extend OmniLink Route 1 to Ft. Belvoir during peak periods; and
- Increase Virginia Railway Express (VRE) train size so that three of the Fredericksburg trains have eight cars and four have six cars.

The new bus services include:

- Shirlington to Rosslyn;
- Central Prince William to downtown Alexandria;

- Kingstowne to Shirlington to Pentagon;
- Woodbridge to Lorton/Tysons to Merrifield;
- Lake Ridge to Seminary Road area;
- Fredericksburg to Pentagon/Crystal City;
- Fredericksburg to Washington, D.C.;
- Massaponax to Washington, D.C.; and
- Lorton VRE station to EPG/Ft. Belvoir (new shuttle).

The recommended facility improvements include:

- Three new and improved transit centers;
- Four in-line BRT stations along HOT lane corridor;
- VRE Fredericksburg line platform extension at four stations;
- Increased overnight parking for VRE trains in Fredericksburg; and
- 3,750 additional new park-and-ride spaces (beyond the 3,000 proposed in the I-95/I-395 HOV/Bus/HOT Lane Project scope).

Developing the park-and-ride recommendations for the Fiscally Constrained Recommendation required allocating the available funding for spaces in a manner intended to balance multiple factors:

- Provide parking for the proposed in-line stations;
- Address areas with the largest difference between forecasted demand and forecasted capacity; and
- Minimize partial funding of park-and-ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots).

The prioritization of park-and-ride needs led to several recommendations. It was recommended that the 3,000 spaces included in the scope of the I-95/I-395 HOV/Bus/HOT Lanes project be allocated as follows:

- 450 spaces in the Springfield/Lorton subarea;
- 300 spaces for the Massaponax transit center in the Fredericksburg subarea;
- 1,050 spaces at the proposed VA 610 at U.S. 1 lot; and
- 1,200 additional spaces at the Prince William Parkway (Horner Road) lot.

It was further recommended that the $37.5 million allocated for park-and-ride spaces as part of the transit/TDM strategies be used to build the following spaces:

- 175 spaces for the Fredericksburg subarea;
- 1,075 spaces for the North Stafford subarea;
- 250 spaces for the Potomac Mills subarea at the PRTC transit center; and
- 1,500 spaces needed at the VRE stations.

The enhanced and new TDM programs include capital assistance for vanpools, enhanced Guaranteed Ride Home program, financial incentives for vanpools and carpools, rideshare program operational support, TDM program marketing support, and telework program assistance.

The resulting Fiscally Constrained Recommendation was used to amend the placeholder transit/TDM program submitted to the MWCOG CLRP in 2007 as part of the I-95/I-395 HOT Lane Project. Additional study is needed to further design elements of the fiscally constrained program, including performing traffic analysis and conceptual engineering on park-and-ride and in-line station aspects. In addition, further study of transit and other mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOT Lane Project may be desired.

# 1.0 Introduction

## *1.1 Purpose*

The I-95/I-395 Transit/TDM Study was conducted by the I-95/I-395 Transit/TDM Technical Advisory Committee (TAC) consisting of members from Federal, state and local jurisdictions, transit agencies, and transportation demand management (TDM) providers in cooperation with the Virginia Department of Rail and Public Transportation (DRPT). The purpose of the study was to provide the Commonwealth, transportation leaders, and decision-makers in the affected region with recommendations on a comprehensive approach to the future provision of transit and TDM services and programs in the I-95/I-395 corridor.

The study was performed by a consultant team led by Cambridge Systematics, Inc. (CS) and included KFH Group (KFH), Southeastern Institute of Research (SIR), LDA Consulting (LDAC), and William G. Allen (WGA). The consultant team worked with the TAC and DRPT to develop a comprehensive alternative transportation plan to enhance mobility through the increased provision and use of transit and TDM services in the corridor.

The multimodal transportation planning effort utilized the results of a market research survey, travel demand forecasting, park and ride forecasting, and transportation demand management modeling, as well as the expertise of the TAC to develop and evaluate alternative program investments. The study provides a recommended transit/TDM plan for the corridor and details the cost and the entities potentially responsible for implementation and operation of the services/ improvements identified. The work on this study was completed in coordination with the work being done on the I-95/I-395 Public-Private Transportation Act (PPTA) project by Fluor-Transurban and the Virginia Department of Transportation (VDOT).

## *1.2 Background*

VDOT has entered into an interim agreement with Fluor-Transurban to build 56 miles of managed lanes in the I-95/I-395 corridor between Arlington and Massaponax, south of Fredericksburg. The final negotiated Comprehensive Agreement will be structured as a concession, meaning that the private partner will operate and maintain the managed lanes for an agreed-upon period of time in exchange for the right to collect tolls on the lanes. There are two elements of the proposed I-95/I-395 project:

- Expansion of the existing two-lane high-occupancy vehicle (HOV) system to three lanes and conversion of the existing system to an HOV/high-occupancy toll (HOT) lane system; and

- Extension of this HOV/HOT lane system an additional 28 miles south from the existing system to Fredericksburg.

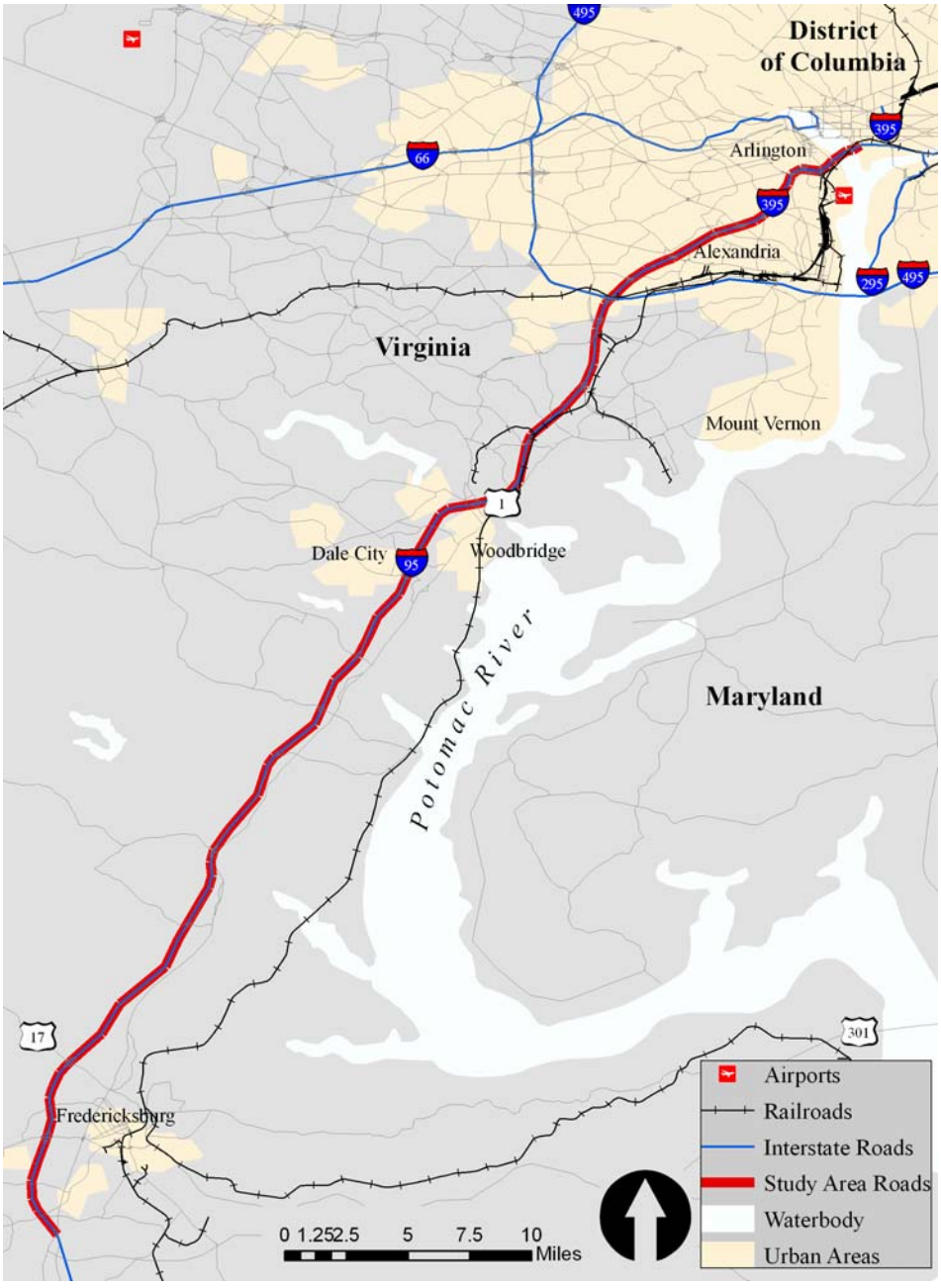
In accordance with the Public-Private Transportation Act of 1995, as amended, as well as Section 33.1-23.03:9 of the Code of Virginia governing the use of any concession payments, this study will help shape the Commonwealth's approach to using concession payments for the provision of transit/TDM services in the corridor.

The Commonwealth Transportation Board will be responsible for allocating revenues that become available through the I-95/I-395 High Occupancy Vehicle (HOV)/Bus/High Occupancy Toll (HOT) Lanes Project for transit and transportation demand management improvements. The recommendation of the I-95/I-395 Transit/TDM Study represents an initial planning effort with the understanding that additional analysis and coordination with service providers will be needed prior to the expenditure of any funds.

## *1.3 Study Area*

The study area comprises an area approximately five miles on either side of the corridor defined by I-95/I-395 from U.S. 1 and I-95 near Massaponax in the south to the Potomac River in the north. The MWCOG model region was used for travel forecasting analysis. Figure 1-1 shows the general vicinity and extents of the study corridor and area. Key destinations in the study area were identified to be Washington D.C. (core and noncore), Pentagon/Pentagon City/Crystal City, Shirlington, Mark Center/Skyline, Tyson's Corner, Merrifield, Alexandria, Fort Belvoir/EPG/ Springfield, Woodbridge, Quantico, and Garrisonville-Aquia.

**Figure 1-1. Vicinity and Extents of the Study Corridor**



## *1.4 Study Process*

This project was executed as a series of closely associated subtasks for greater efficiency. The overall study process is shown schematically in the Figure 1-2. Subtasks involved were:

- **Task 1 –** Data Assembly/Collection;
- **Task 2 –** Baseline Conditions;
- **Task 3 –** Tiered Transit/TDM Alternatives;
- **Task 4 –** Testing and Refinement of Tiered Transit/TDM Alternatives;
- **Task 5 –** Transit/TDM Demand Forecasting and Traffic Modeling;
- **Task 6 –** Sensitivity Analysis;
- **Task 7 –** Park-and-Ride Lots;
- **Task 8 –** Cost/Revenue/Subsidy Projections for the Corridor; and
- **Task 9 –** Investment Strategy.

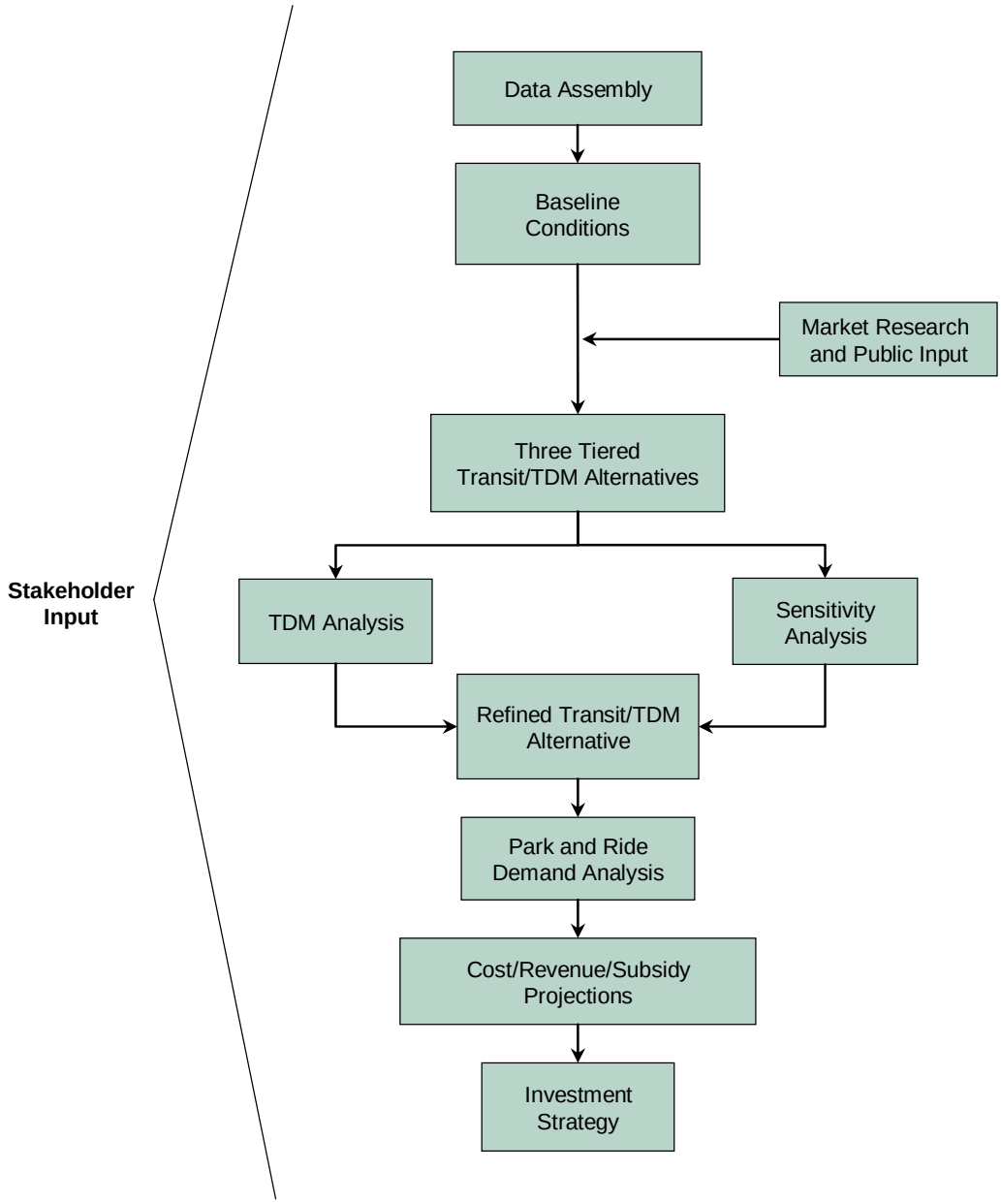
At the beginning of the study the consultant team concurrently set out to identify existing conditions and develop the baseline scenario for the study. Data was assembled on current transit service levels, use, and costs; HOT lane elements; and, future travel markets. The study team also developed an on-line market research survey to help identify public opinion and attitudes.

A baseline scenario for horizon years 2015 and 2030 was then developed. Next, three preliminary tiered alternatives (low, medium, and high) were proposed for each horizon year based on the Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Transportation Plan (CLRP). The preliminary tiered alternatives were refined and finalized based on stakeholder input and qualitative testing. Concurrently, public outreach and market research activities proceeded.

Then, the tiered transit/TDM alternatives were tested using the travel demand forecasting models and a single refined alternative was developed. Other sensitivity analyses also were performed. A special model analysis was also performed to inform the review of the TDM elements of the alternatives, and a park-and-ride demand study also was performed to identify the recommended location and quantity of new park-and-ride capacity.

In the final stage of the study, cost and revenue projections for a recommended investment strategy were developed. This investment strategy forms the heart of a recommended fiscally constrained transit/TDM program for adoption in the appropriate CLRPs for MWCOG and FAMPO.

**Figure 1-2. Study Process**




## *1.5 Study Communication and Outreach*

The study involved an extensive communication and outreach program, both in terms of professional cross-jurisdictional collaboration and in terms of providing information to the public. The following subsections describe the Transit/TDM TAC Meetings, Regional Committee Meetings, Market Research Survey, and Public/Agency Participation Program elements of the program.

### 1.5.1 Transit/TDM Technical Advisory Committee Meetings

A multijurisdictional TAC, which included representatives from local, regional, state, and federal stakeholder organizations, provided technical comments and feedback to the DRPT study team throughout the study process. The TAC met approximately once per month during the course of the study. The TAC members are listed below:

- Arlington County – Tamara Ashby and Lynn Rivers;
- City of Alexandria – Jim Maslanka;
- Department of Defense – Phyllis Kaplan;
- Fairfax County – Randall White and Jaak Pedak;
- Fredericksburg Regional Transit (FRED) – Kathleen Beck;
- George Washington Regional Commission (GWRC)/Fredericksburg Area Metropolitan Planning Organization (FAMPO) – Lloyd Robinson and Diana Utz;
- Metropolitan Washington Council of Governments – Don McAuslan;
- Northern Virginia Transportation Commission (NVTC) – Rick Taube;
- Potomac and Rappahannock Transportation Commission (PRTC) – Alfred Harf and Eric Marx;
- Stafford County – Sara Woolfended and Fulton deLamorton;
- Virginia Department of Transportation (VDOT) – Rahul Trivedi, Larry Cloyed and Valerie Pardo;
- Virginia Railway Express (VRE) – Christine Hoeffner; and
- Washington Metropolitan Area Transit Authority (WMATA) – Wendy Jia and Fred Simms.

### 1.5.2 Regional Committee Meetings

The project team met with FAMPO/GWRC, NVTA, NVTC, and PRTC, approximately every other month, to present the status of the project, including a description of the major deliverables completed by the time of that meeting. Handouts for these meetings were available to attending members of the public and also posted to the affiliated organization web sites.

### 1.5.3 Market Research Survey

A market research survey was conducted as part of this study in order to profile current travel patterns by mode in the study corridor and to profile expected changes in travel behavior as a result of the construction and operation of the HOT lanes project. The survey was used to identify the relative appeal of specific enhancements and programs needed to increase the likelihood of using alternatives to driving alone and also to assess the relative impact of alternatives to help calibrate subsequent modeling activities. The survey also helped raise awareness of the study – postcards were mailed to some 75,000 households and direct e-mail lists with thousands of additional contacts were used to reach other potential participants.

### 1.5.4 Public Participation Program

As an integral part of the study process, a public information program was conducted jointly with VDOT. Presentation boards, slides, handouts, and website materials were developed for the purpose of informing interested citizens about the study process and to solicit input for use in the

study. In-person meetings were conducted on five dates in July in five separate locations across the entire study area: Arlington, Fairfax, Prince William, Fredericksburg, and Spotsylvania. All materials from the meetings were posted to the Internet to extend the potential reach.

# 2.0 Existing Conditions and Baseline Scenario

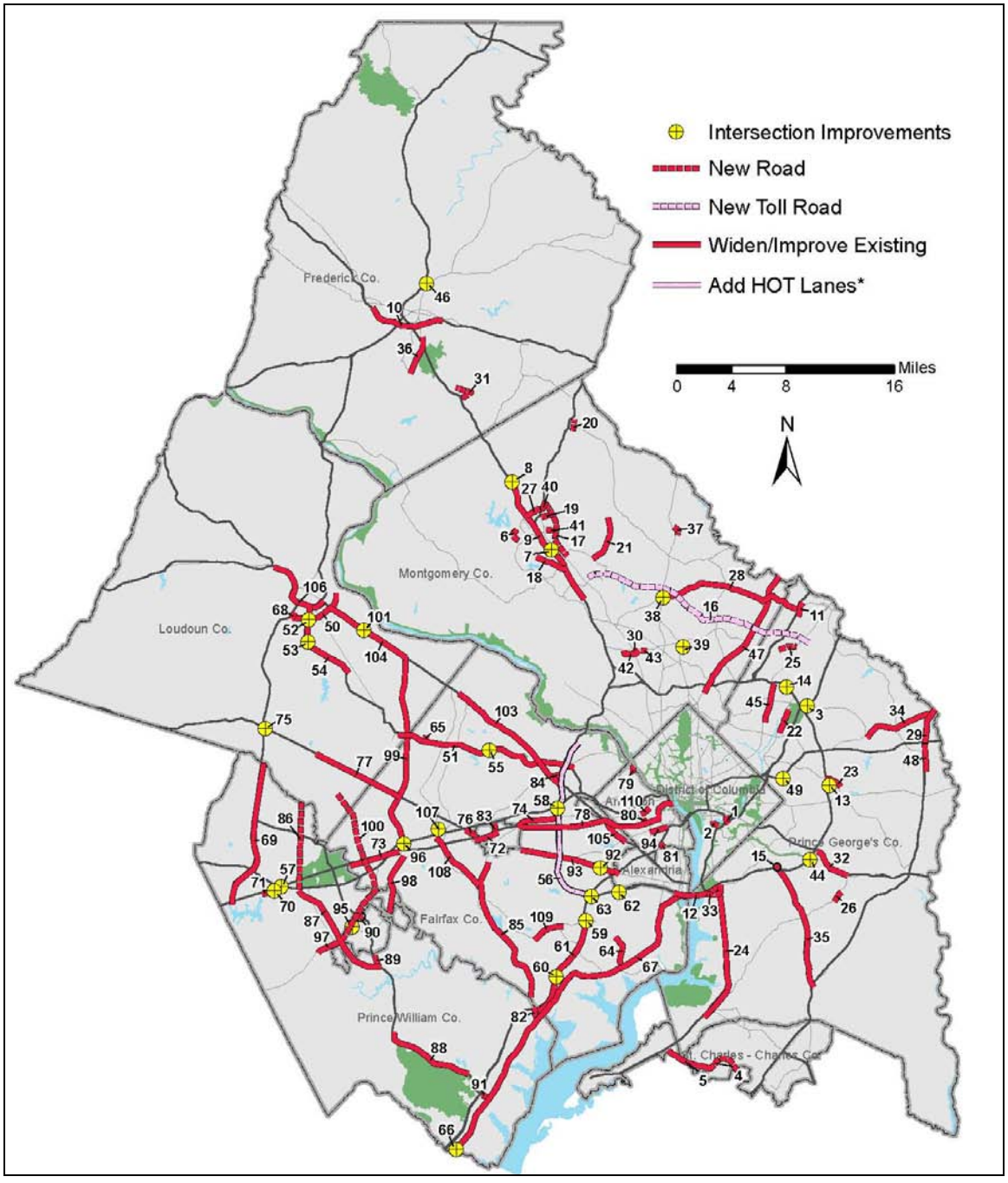
As a first step in the study process, the study team set out to determine existing conditions and to develop both a 2015 and a 2030 baseline scenario. The baseline scenarios were used to evaluate the alternatives. For this study, it was assumed that the projects and services included in the baseline scenarios comprised conditions in the I-95/I-395 corridor that were the combination of existing conditions, the 2006 Metropolitan Washington Council of Governments (MWCOG) Constrained Long-Range Plan (CLRP) improvements, and the I-95/I-395 HOV/HOT lane roadway improvements proposed by VDOT and Fluor-Transurban.[1]

The CLRP for a region includes all regionally significant transportation projects and programs that are planned and a description of the funding mechanism in place or planned to pay for them. For MWCOG, it includes dozens of highway, transit, high-occupancy vehicle (HOV), bike, and pedestrian projects in the area. The study utilized the MWCOG CLRP that was the regionally adopted version (October 18, 2006) at the time of the study. Figures 2-1 through 2-3 show the improvements planned in the 2006 MWCOG CLRP (further information on the CLRP is available at http://www.mwcog.org/clrp).

The TAC helped to define the baseline scenario conditions and agreed to key assumptions for both years 2015 and 2030. The subsections below describe the key components, including existing conditions, land use forecasts, highway network, and transit/transportation demand management (TDM) Programs and Services. The same land use forecasts and highway network that are used for the baseline scenario also are used with the tiered transit/TDM alternatives.

[1] Fredericksburg Area Metropolitan Planning Organization (FAMPO) CLRP improvements could not be included directly since the FAMPO CLRP was not yet complete, but FAMPO provided input into the MWCOG CLRP and through the TAC.

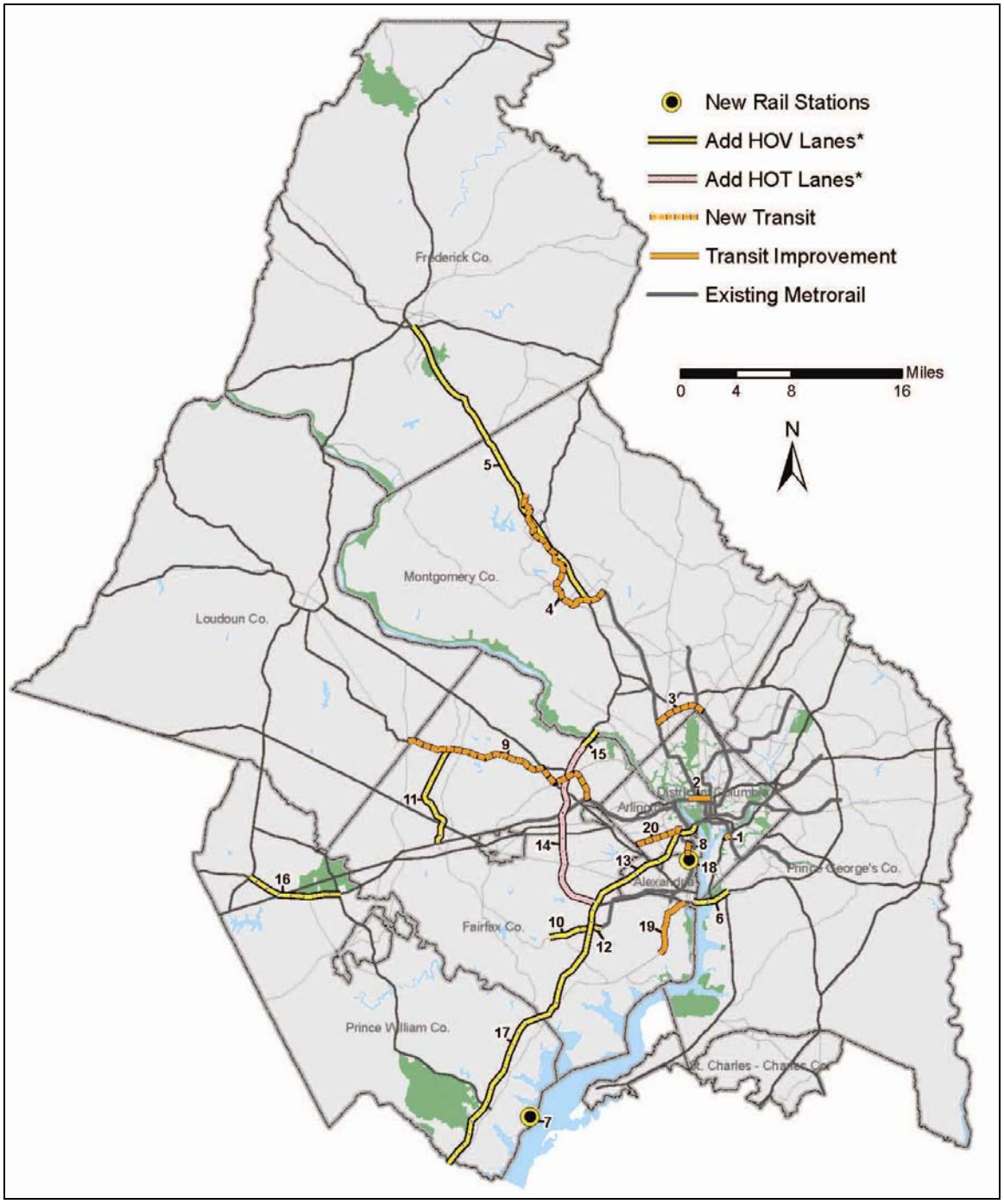
## Figure 2-1. 2006 MWCOG CLRP Major Highway Improvements




Source: http://www.mwcog.org/clrp.

* HOT – High-Occupancy/Toll.

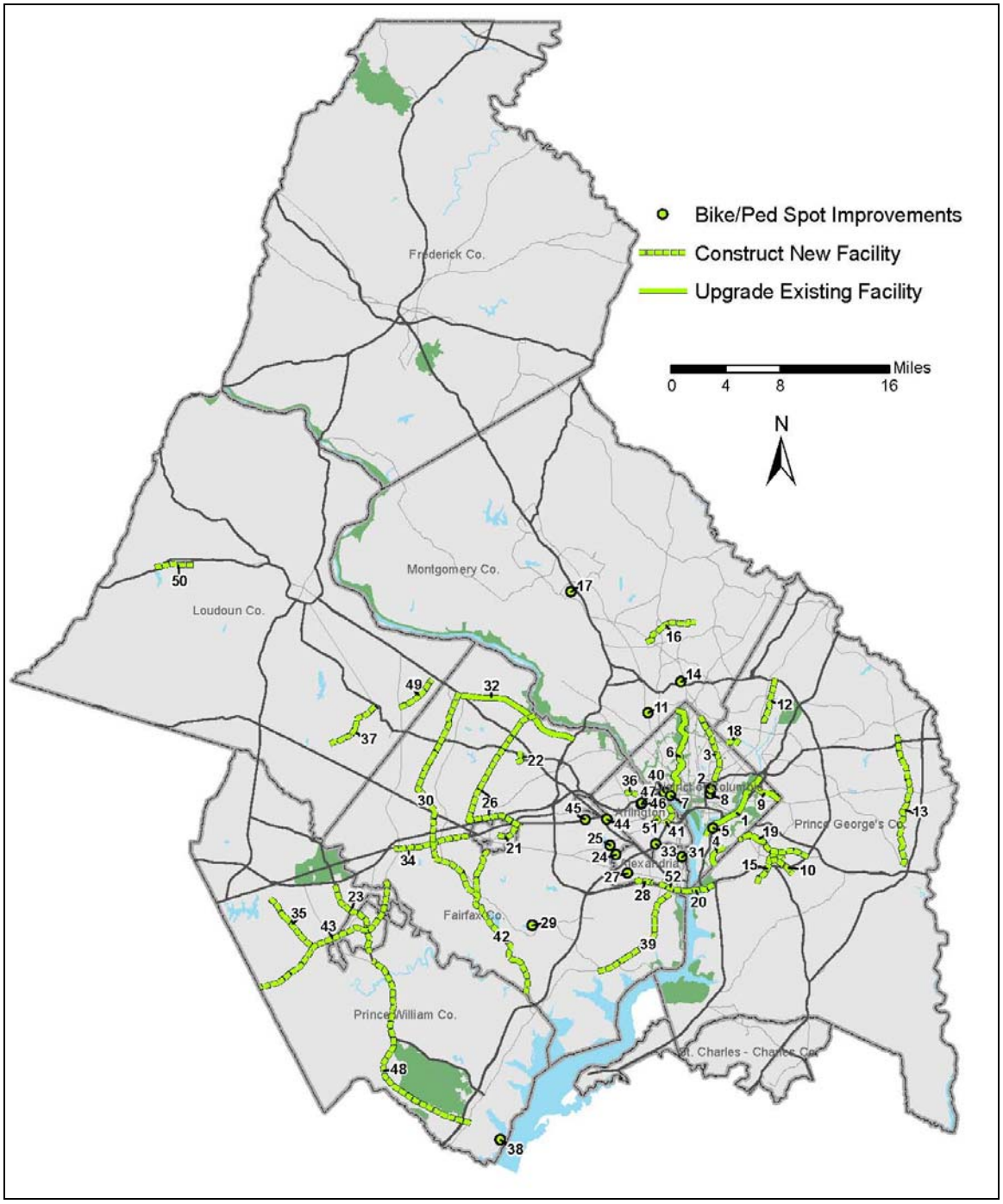
## Figure 2-2. 2006 MWCOG CLRP Major Transit and HOV Improvements




Source: http://www.mwcog.org/clrp.

* HOT – High-Occupancy/Toll; HOV – High-Occupancy Vehicle.

**Figure 2-3. 2006 MWCOG CLRP Major Bike and Pedestrian Improvements**




Source: http://www.mwcog.org/clrp.

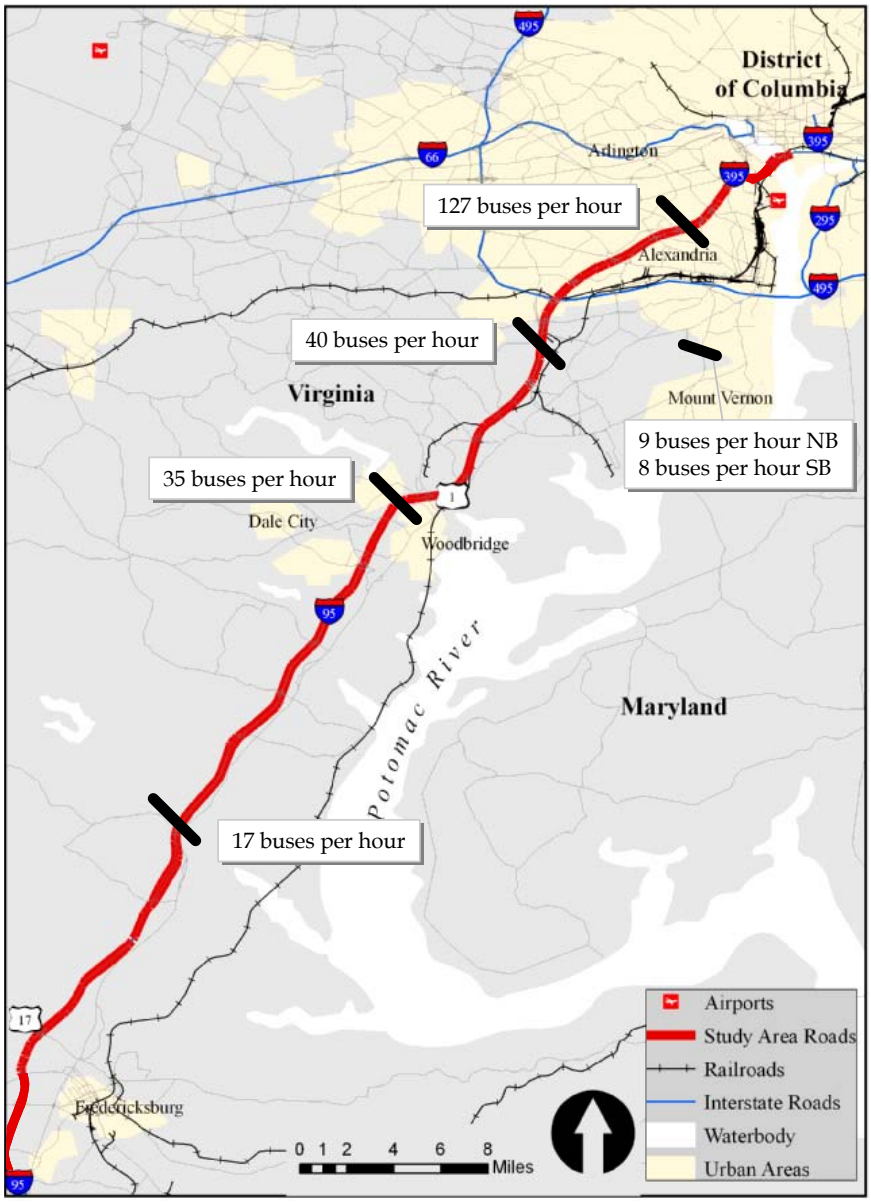
## *2.1 Existing Conditions*

This section presents a description of the existing conditions in the study area including a summary of existing transit service, existing TDM programs and services, and existing transit and carpool usage.

### 2.1.1 Existing Transit Service

During the morning peak period, there are over 127 buses operating per hour in the northern portion of the corridor and about 17 buses operating per hour in the southern portion of the corridor. There are 10 WMATA Metrorail trains per hour, 2 VRE trains every hour, and 2 Amtrak trains in the morning peak period servicing the study corridor. Figure 2-4 illustrates the bus service for the year 2005 in the morning peak.

**Figure 2-4. 2005 Bus Service I-95/I-395 – AM Peak**




Source: MWCOG/TPB Travel Forecasting Model V2.1D#50 2006 CLRP FY 2007-2012 TIP.

### 2.1.2 Existing TDM Programs and Services

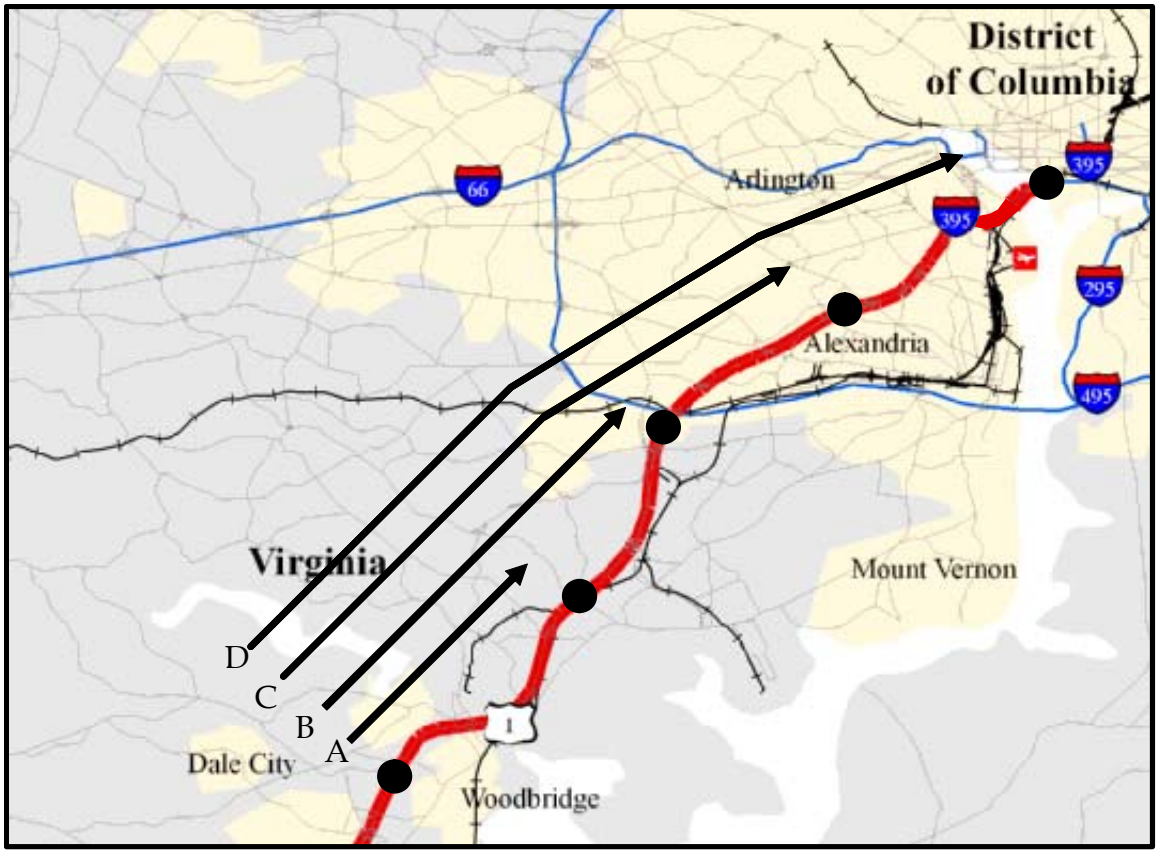
A variety of TDM programs and services currently operate in the study corridor, including:

- Five-hundred Vanpools;
- Twenty-one Park-and-Ride Lots;
- Nineteen Slug Locations;
- Five Rideshare/Employer Services Programs;
- VanStart/VanSave;
- Guaranteed Ride Home Program;
- NuRide Carpool Incentives;
- Commuter Stores;
- Metrochek Redemption Centers;
- Four Telework Centers; and
- Telework!Va Program.

### 2.1.3 Existing Mode Share

Figures 2-5 and 2-6 illustrate the mode share in the morning peak period for selected markets along the study corridor. The transit mode share of trips traveling from points south of Dale City along I-95 to the core increases gradually as the destination gets closer to the core. The core, due to its higher density, attracts more transit trips than other parts of the corridor. Conversely, the low-occupancy vehicle (LOV) mode share (trips with one or two occupants) drops dramatically closer to the core, as transit already is a very popular choice for trips originating south of Dale City and headed north along I-95. The transit and high-occupancy vehicle (HOV) mode shares for trips into the core are very high and indicate that the proposed transit service for the high-occupancy toll (HOT) facility should try to maintain these types of mode shares.

## Figure 2-5. I-95/I-395 AM Peak Hour Mode Shares – Selected Markets




(A) Originating at or South of Dale City on I-95 and destined to Lorton.

Transit <1%
HOV 13%
LOV 87%

(B) Originating at or South of Dale City on I-95 and destined to Springfield.

Transit 0%
HOV 7%
LOV 93%

(C) Originating at or South of Dale City on I-95 and destined to Alexandria.

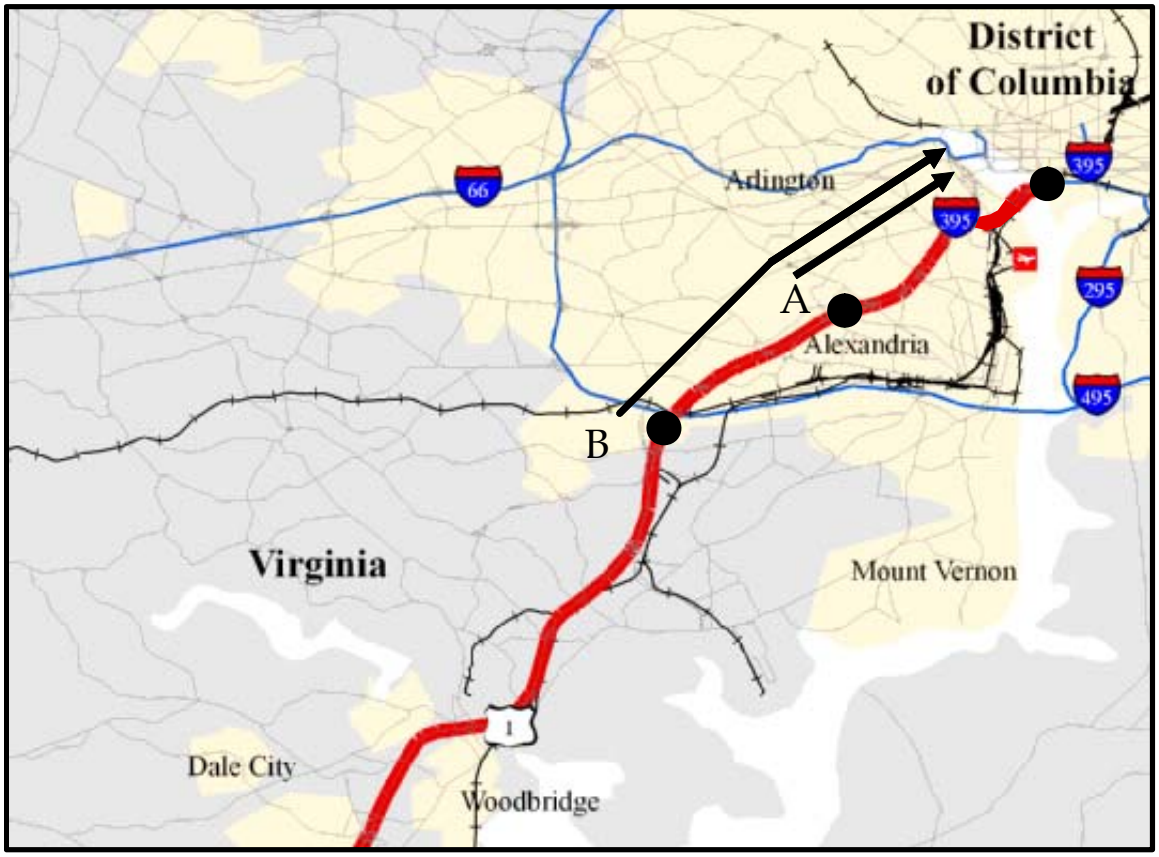
Transit 6%
HOV 4%
LOV 90%

(D) Originating at or South of Dale City on I-95 and destined to core.

Transit 6%
HOV 4%
LOV 90%

Source: *I-95 HOV Feasibility Study*, VDOT, March 2002.

**Figure 2-6. I-95/I-395 AM Peak Hour Mode Shares – Selected Markets**




(A) Originating at Alexandria on I-95 and destined to the core.

| | |
|---|---|
| Transit | 32% |
| HOV | 0% |
| LOV | 68% |

(B) Originating at Springfield on I-95 and destined to the core.

| | |
|---|---|
| Transit | 17% |
| HOV | 18% |
| LOV | 65% |

Source: *I-95 HOV Feasibility Study*, VDOT, March 2002.

## *2.2 Land Use Forecasts*

The source of the land use forecasts used for the study was the MWCOG regional travel demand forecast model (Version 2.1D#50). Figures 2-7 through 2-10 show the forecast population and employment density in the study area for 2015 and 2030.

**Figure 2-7. Population Density in the Study Area in 2015**

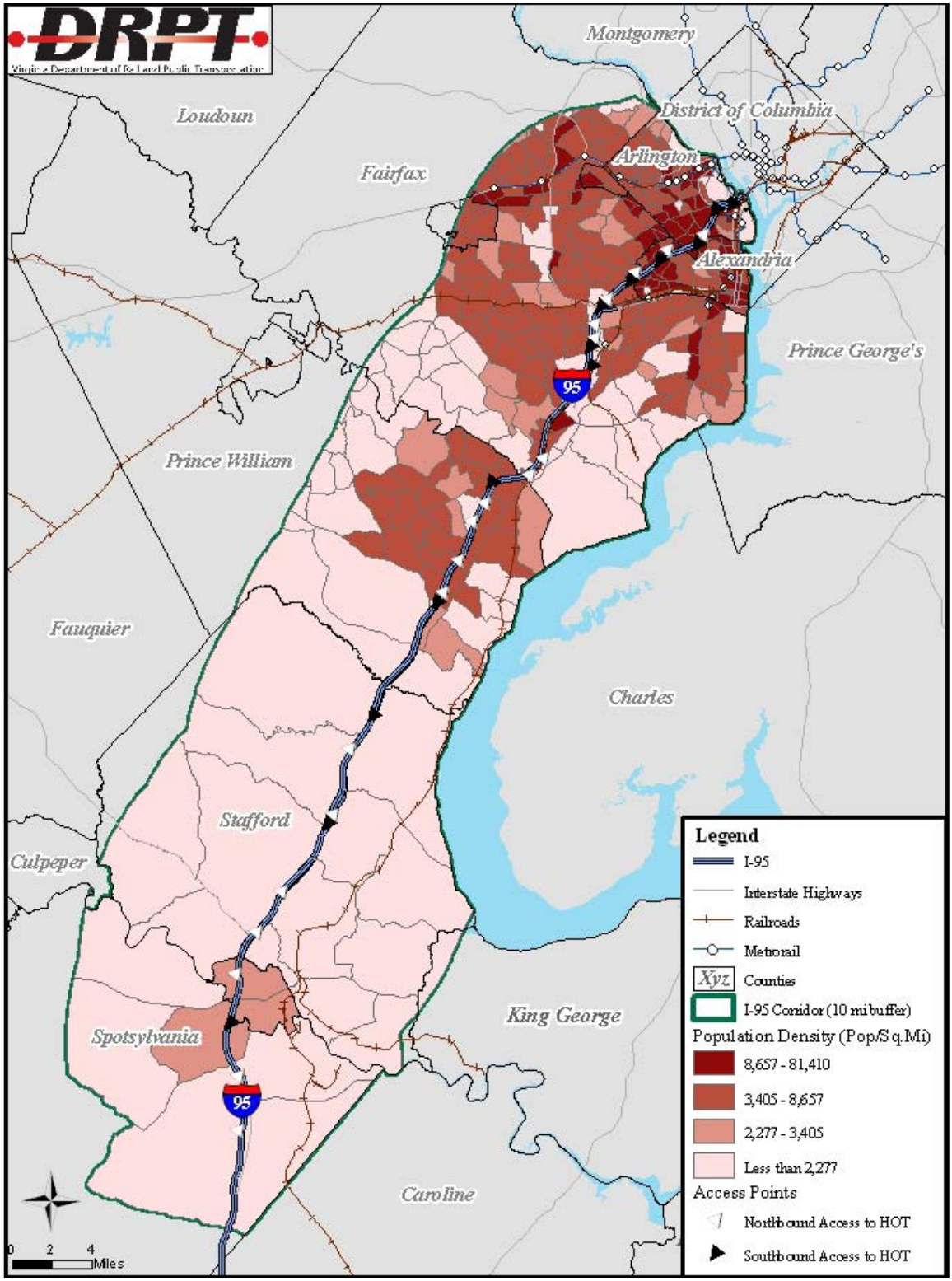


**Figure 2-8. Employment Density in the Study Area in 2015**

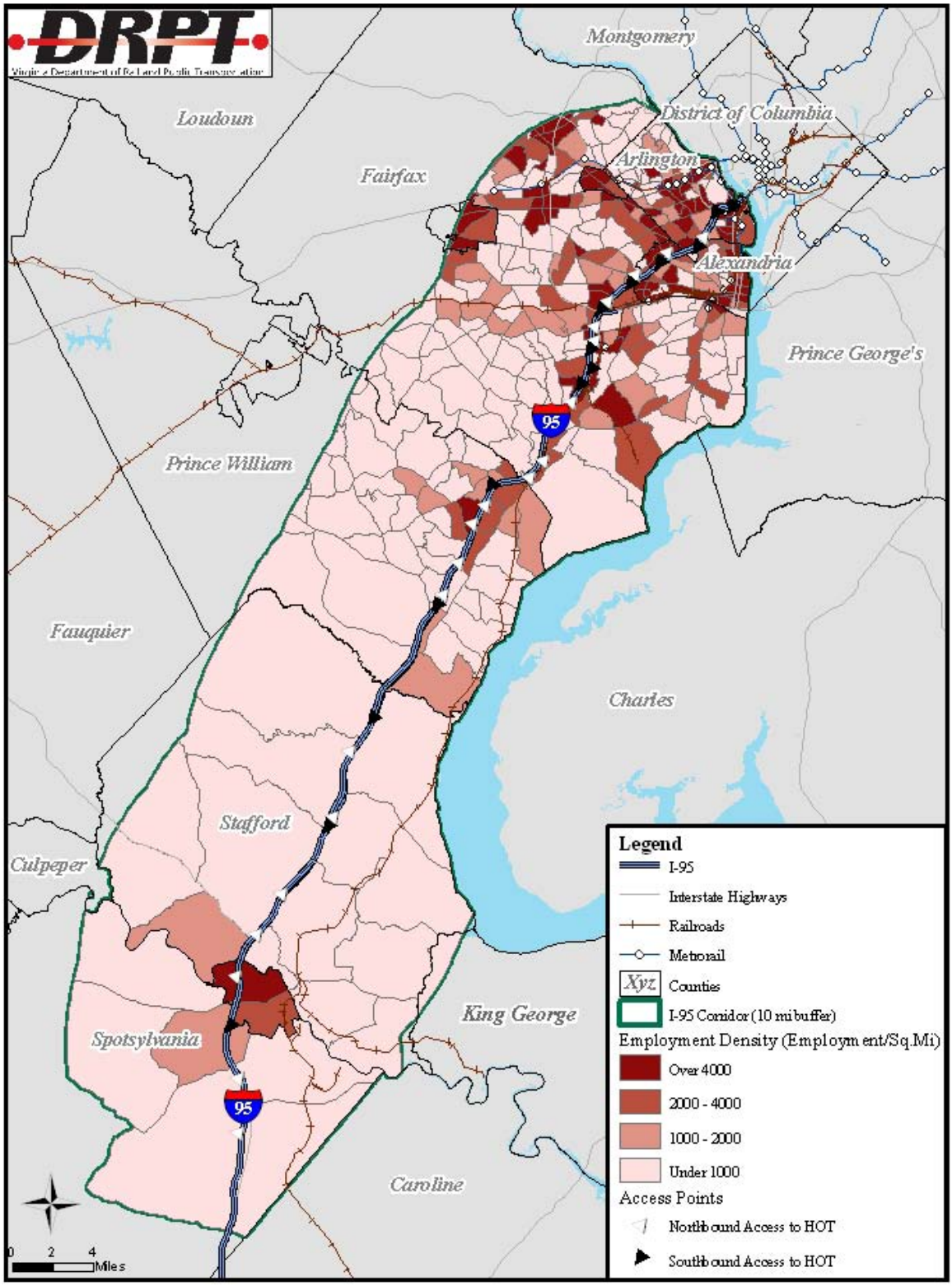


**Figure 2-9. Population Density in the Study Area in 2030**

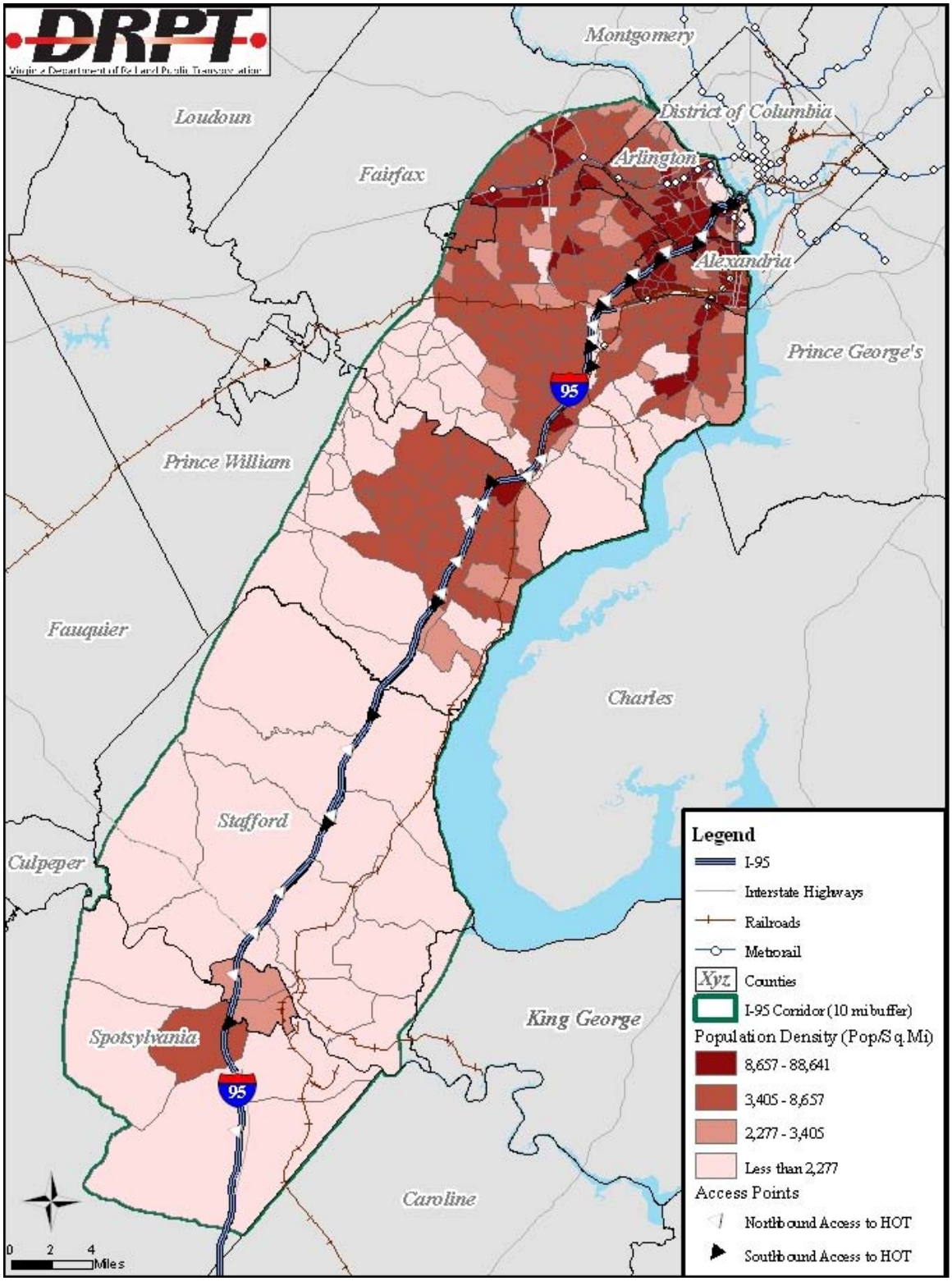
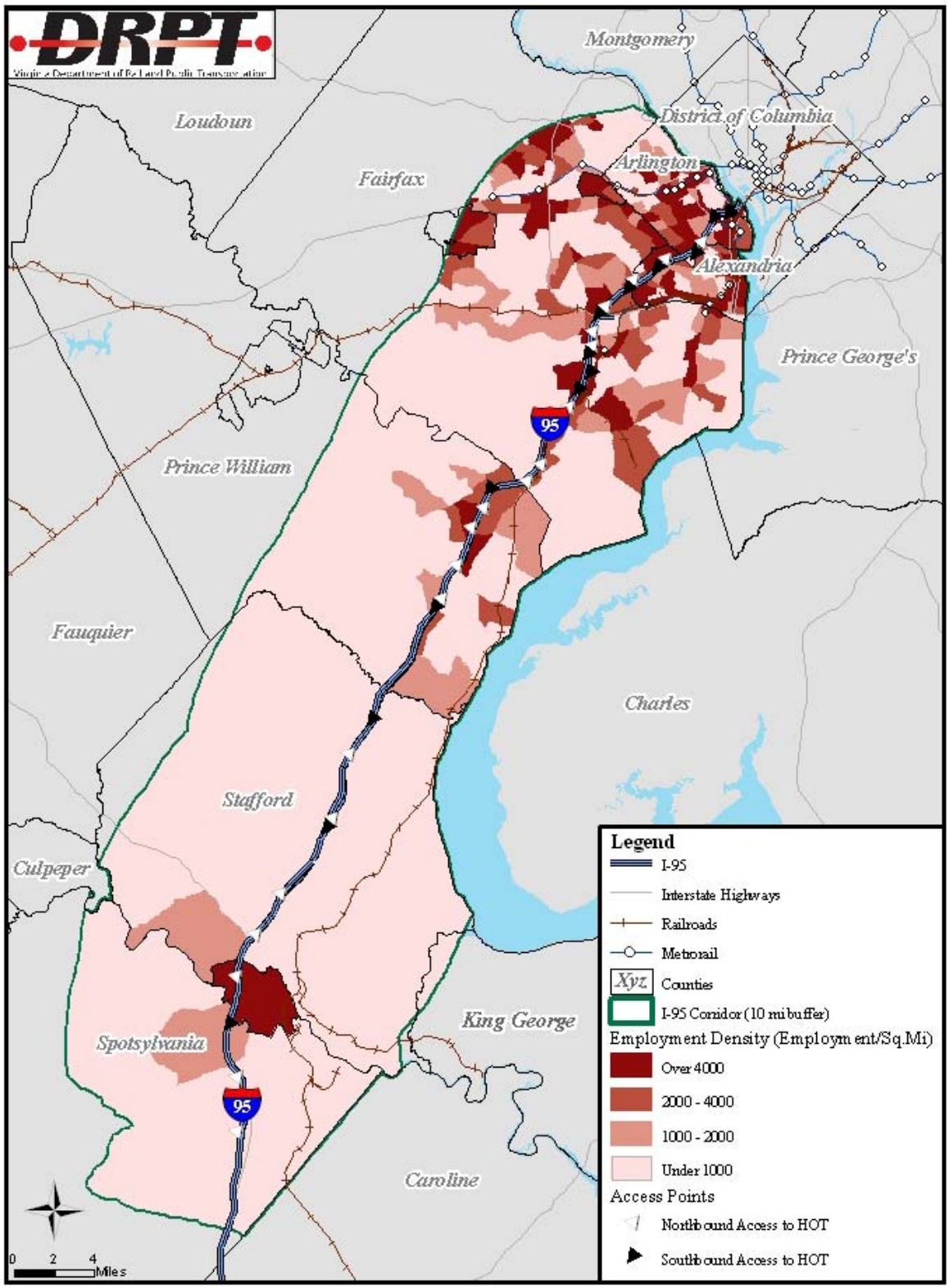


**Figure 2-10. Employment Density in the Study Area in 2030**



## *2.3 Baseline Highway Network*

The highway network for the Baseline Scenario consists of the improvements identified in the 2006 MWCOG CLRP. Also included are two projects that create the 70-mile HOT lane network on the Beltway and I-95/I-395. These projects will:

- Add four new high-occupancy toll (HOT) lanes on I-495 from the Springfield Interchange to just north of the Dulles Toll Road;
- Convert the existing reversible HOV system on I-95/I-395 into HOT lanes, expanding it from two lanes to three lanes; and
- Extend two new HOT lanes 28 miles south along I-95 into Spotsylvania County.

## *2.4 Baseline Transit/TDM Improvements*

The baseline scenario service elements were developed using a survey of existing public transit operators, review of public and private operators' web sites and service descriptions, and in-person meetings and/or e-mail discussions with public transit operators to discuss current, anticipated, and potential new services.

Existing services were augmented with the transit services planned in the 2006 MWCOG CLRP. Transit service that could potentially use the HOT lanes was assigned to the HOT lanes. This included service currently using the HOV lanes and future planned transit service that could be on the proposed HOV lanes. Finally, a TAC meeting was used to confirm the baseline transit network.

### 2.4.1 Regional Activity Centers

Transit market opportunity maps were developed to highlight the travel flows between origins within the study area and major destinations based on the MWCOG regional activity centers in order to facilitate the development of the baseline scenario and potential transit markets. Figure 2-11 shows the designated major attraction zones for home-based work trips originating in the I-95 corridor. Figure 2-12 is a sample map that shows the 2015 projected home-based work trips during the morning peak period from the I-95 corridor to north and west Washington D.C. (without I-95/I-395 HOT lanes). Additional maps are provided in Appendix B. These maps served as a useful device for soliciting TAC input on existing and planned transit service (including express bus/bus rapid transit, Metrorail, and commuter rail services) and TDM programs (including slugging, carpooling, vanpooling, and park-and-ride facilities) in the I-95, I-395, I-495, and Route 1 corridors.

**Figure 2-11. Major Attraction Zones for Projected Home-Based Work Trips Originating in the Study Corridor**

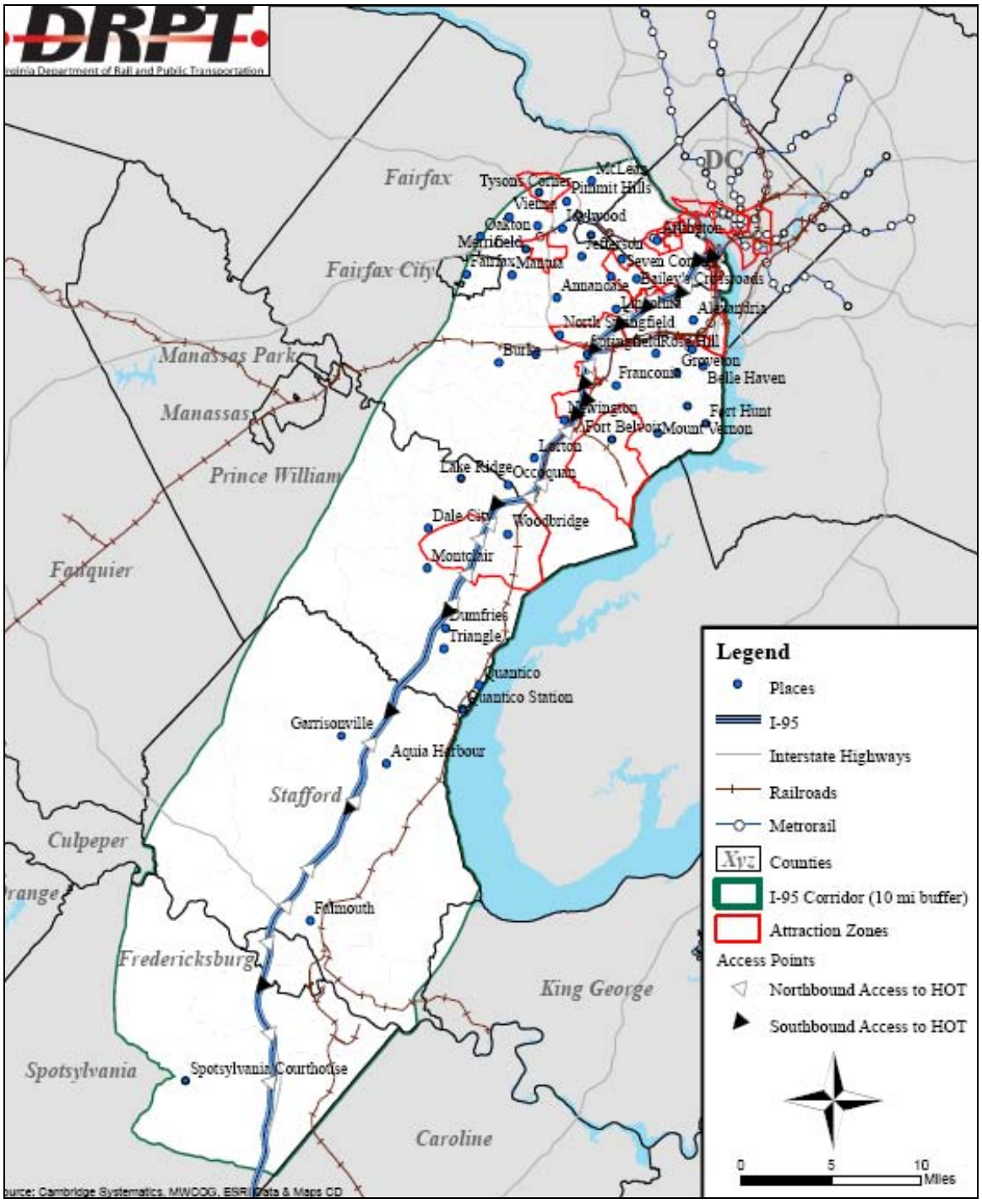
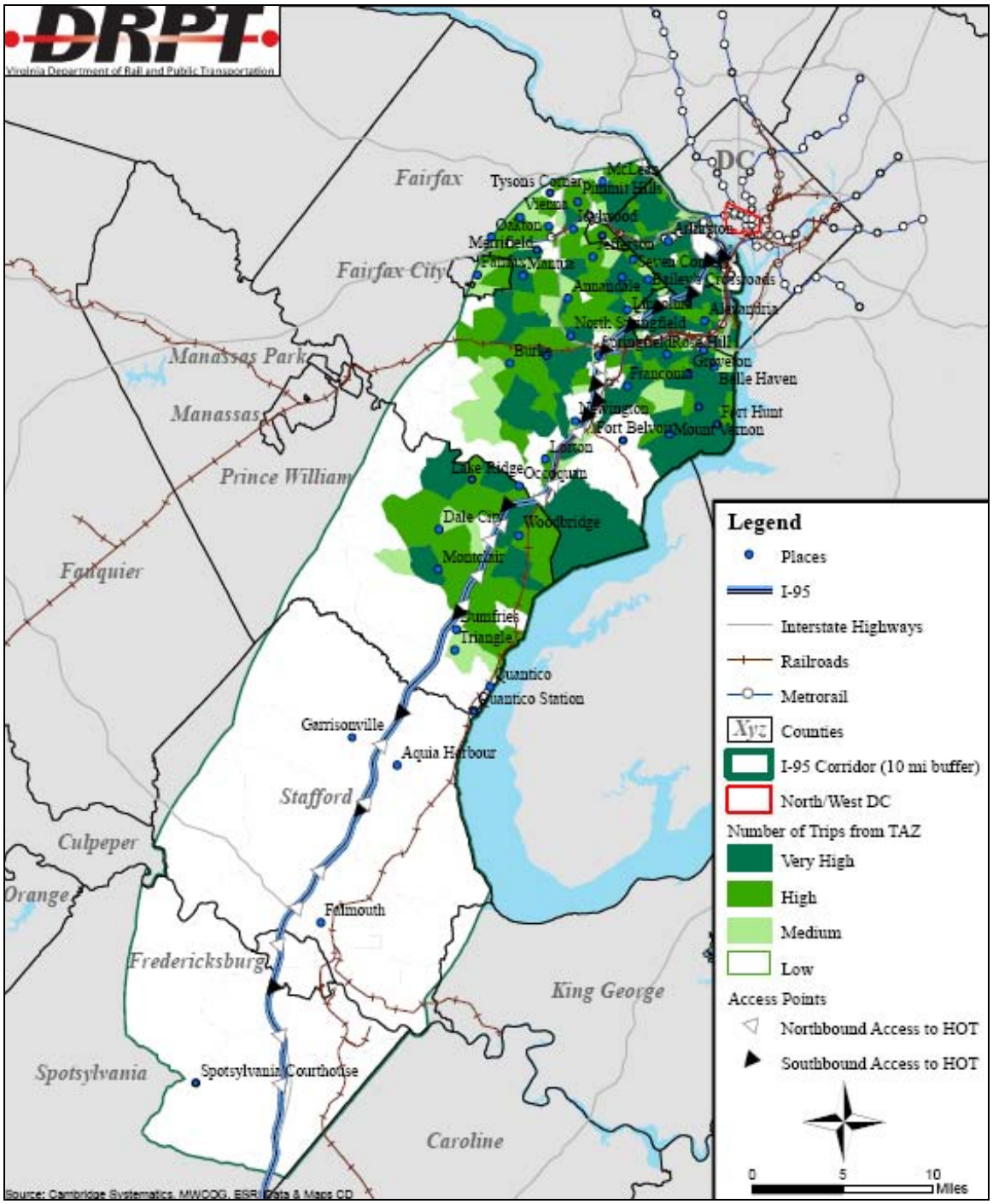


**Figure 2-12. 2015 Projected Home-Based Work Trips during AM Peak Period from Study Corridor to North and West Washington D.C.**



## Table 2-1. Baseline (Existing and Planned Transit Service by Subarea)

| Area | Current Transit Service in I-95/I-395 Corridor (From These Areas) | Summary of Current Services | Transit Improvements Planned in MWCOG CLRP[a] |
|---|---|---|---|
| Alexandria/ Arlington Areas | **Metrorail –** Ten rail stations provide service in metro area.<br><br>**Metrobus –** Thirty-one routes provide local bus, commuter bus to D.C., and feeder bus to Metrorail stations.<br><br>**Alexandria DASH –** Seven routes provide local and feeder bus, mostly oriented toward the city, two routes to Pentagon use the HOV lanes.<br><br>**Arlington ART –** Provides local and feeder bus, two routes use the HOV lanes to feed Pentagon City Metrorail station.<br><br>**VRE/Amtrak –** Commuter rail to/from Alexandria and Crystal City stations. | **Direct Links –** Local transit systems, WMATA, and VRE/ Amtrak provide a relatively high level of transit service inside the beltway. Most of these services are not directly affected by changes to the HOV lanes.<br><br>**Feeder Connections –** Local transit systems and Metrobus provide connections to and from Metrorail and VRE/Amtrak stations. | Headway Improvements on Existing Routes:<br>• Increase VRE by two trains per hour northbound; one train per hour southbound.<br><br>Route Realignments:<br>• Route 7 realignment 7X/7W start in West End of Alexandria area.<br><br>New Routes or Services:<br>• Increased service on Columbia Pike (more than 3 buses per hour); and<br>• Increase Service I-395 NB (more than 14 buses per hour).<br><br>Capital Improvements:<br>• Improvements to Metrorail stations at King Street, Crystal City, and Pentagon;<br>• New Metrorail station at Potomac Yard;<br>• Transfer facilities at Columbia Pike/S. Walter Reed and Shirlington/31st Street;<br>• Transit Center at King Street/Braddock;<br>• Crystal City Busway with upgrade to BRT in 2012; and<br>• HOT lanes on Beltway. |

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

## Table 2-1. Baseline (Existing and Planned Transit Service by Subarea) (continued)

| Area | Current Transit Service in I-95/I-395 Corridor (From These Areas) | Summary of Current Services | Transit Improvements Planned in MWCOG CLRP[a] |
|---|---|---|---|
| Springfield/ Fairfax Areas | **Fairfax Connector –** Twenty-three routes provide local and feeder service to Metrorail, 1 route operating from Springfield Metro station to Pentagon uses HOV lanes.<br><br>**WMATA –** Some of the 31 routes provide local bus, commuter bus to D.C., and feeder bus to Metrorail stations.<br><br>**VRE/Amtrak –** Commuter rail to Alexandria, Crystal City, D.C. from Springfield and Lorton stations. | **Direct Links –** Fairfax Connector, WMATA, and VRE/Amtrak provide a relatively high level of service for commuters into D.C./ Arlington core from Springfield and Fairfax.<br><br>**Feeder Connections –** Fairfax Connector and Metrobus provide connections to and from Metrorail/VRE/Amtrak Stations. | Headway Improvements on Existing Routes:<br>• Increase VRE by one train per hour northbound and one train per hour southbound;<br>• Metro Blue Line decrease one train per hour; and<br>• Increase service I-95 Northbound (more than 26 buses per hour).<br><br>Route Realignments:<br>• Fairfax Connector realignments/streamlining Mt. Vernon Area and Springfield Area.<br><br>New Routes or Services:<br>• New service on the I-495 HOT lanes connecting Dulles, Fairfax, Alexandria, Annandale, and Tysons Corner (28 buses per hour on Inner Loop).<br><br>Capital Improvements:<br>• Improvements to Metrorail station at Huntington;<br>• Platform extension at Eisenhower Avenue Metrorail; and<br>• Study Metrorail from Springfield to Potomac Mills Mall. |
| Prince William Area | **PRTC –** Eleven routes operate in the corridor to provide commuter bus service from Pentagon, Crystal City, and D.C.; and feeder bus service to Springfield Metro station. Commuter routes circulate through community. | **Direct Links –** PRTC and VRE provide relatively high level of service for commuters from the Woodbridge/Dale City area into D.C./Arlington core. | Headway Improvements on Existing Routes:<br>• Increase VRE by one train per hour northbound and one train per hour southbound;<br>• Improve bus service in Woodbridge/Potomac Mills Area; and<br>• Increase service I-95 northbound (more than 27 buses per hour). |

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

[b] The access point in the Quantico Area does not appear to be “transit friendly” since it is one-directional – e.g., northbound morning buses could get off but not back on to continue on route.

## Table 2-1. Baseline (Existing and Planned Transit Service by Subarea) (continued)

| Area | Current Transit Service in I-95/I-395 Corridor (From These Areas) | Summary of Current Services | Transit Improvements Planned in MWCOG CLRP[a] |
|---|---|---|---|
| Prince William Area (continued) | **VRE/Amtrak –** Commuter rail to Alexandria, Crystal City, D.C. from Woodbridge, Rippon, and Quantico stations. | **Feeder Connections –** PRTC provides connections to Metrorail and VRE/Amtrak stations. | Route Realignments:<br>• Improved bus service in Woodbridge/Potomac Mills area.<br>Capital Improvements:<br>• Extension of HOV lanes from Dumfries to Quantico area;<br>• Study Metrorail from Springfield to Potomac Mills Mall; and<br>• VRE – New Cherry Hill Station. |
| Stafford and Fredericksburg Areas | **FRED –** Local bus in City of Fredericksburg, Stafford, and Spotsylvania County.<br>**VRE/Amtrak –** Provides service to Alexandria, Crystal City, D.C. from Brooke, Leland Road, and Fredericksburg stations.<br>**Martz/Quicks –** Private commuter buses provide 22 round trips to Skyline, Pentagon, Crystal City, and D.C. | **Direct Links –** FRED bus is oriented toward local markets. Commuter service is available through private commuter buses (Martz and Quicks) and VRE/ Amtrak. VRE/Amtrak, Martz, Quicks provide a relatively high level of service from the area into D.C./Arlington.<br>**Feeder Connections –** Local connections to commuter bus and VRE/Amtrak are limited. | Headway Improvements on Existing Routes:<br>• Increase VRE by one train per hour northbound and one train per hour southbound; and<br>• Increase service on I-95 Northbound (more than 16 buses per hour).<br>New Routes or Services:<br>• New service I-95 to I-495 to Springfield Metrorail station, Tysons Corner, and Merrifield (7.5 buses per hour). |

[a] The MWCOG CLRP does not include Stafford and Spotsylvania Counties – FAMPO is developing a CLRP.

[b] The access point in the Quantico Area does not appear to be "transit friendly" since it is one-directional – e.g., northbound morning buses could get off but not back on to continue on route.

### 2.4.2 Baseline Service

The baseline scenario for both years 2015 and 2030 was documented on tables and maps presented to the TAC. Table 2-1 shows the baseline services.

The transit service coverage and frequency is illustrated in two figures. Figure 2-13 shows the transit coverage in the study area for 2030 under the baseline scenario. Figure 2-14 shows the increase in bus service from 2005 to 2030 in the study corridor in the morning peak period.

## Figure 2-13. Transit Coverage in the Study Area for 2030

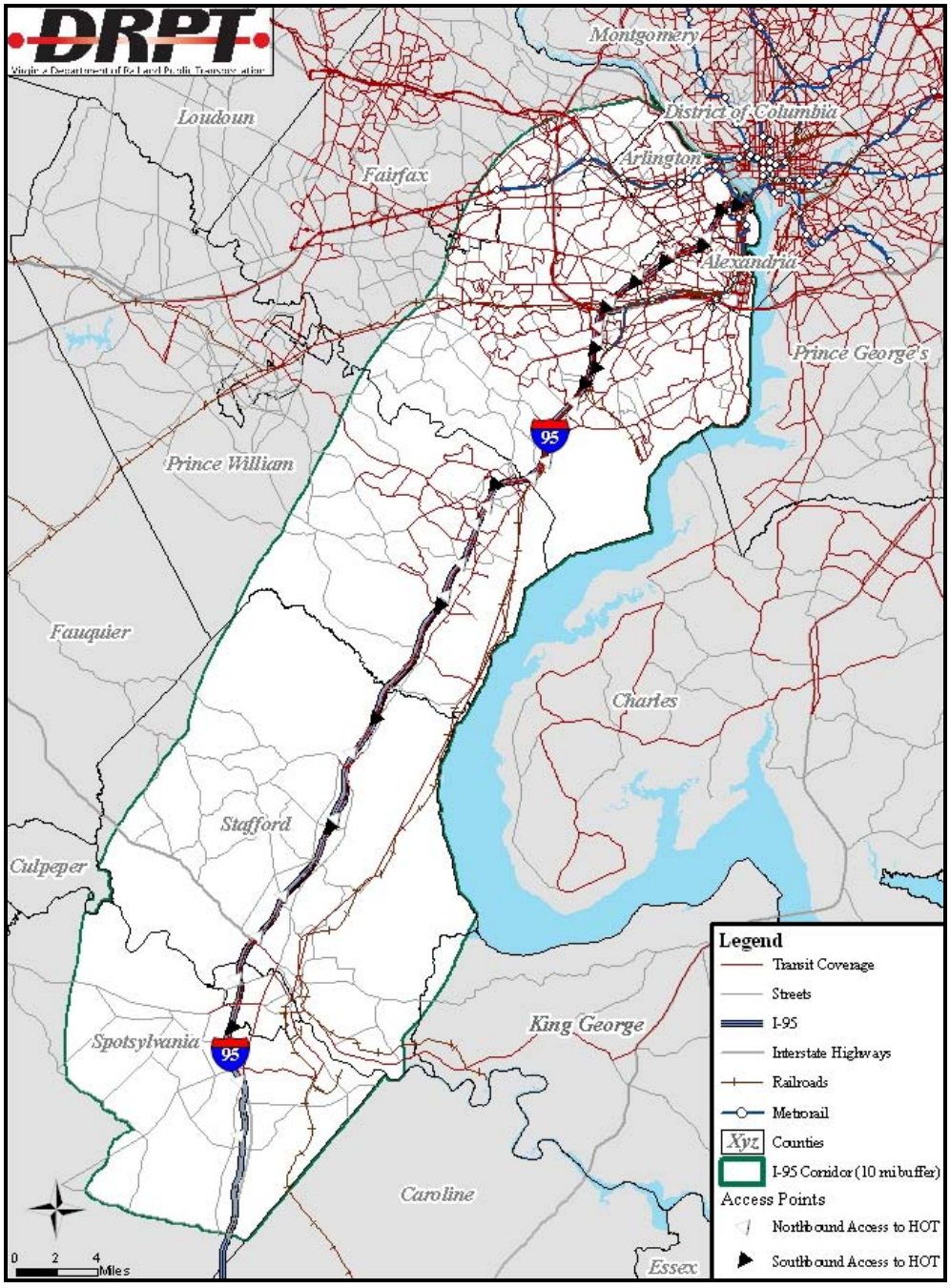
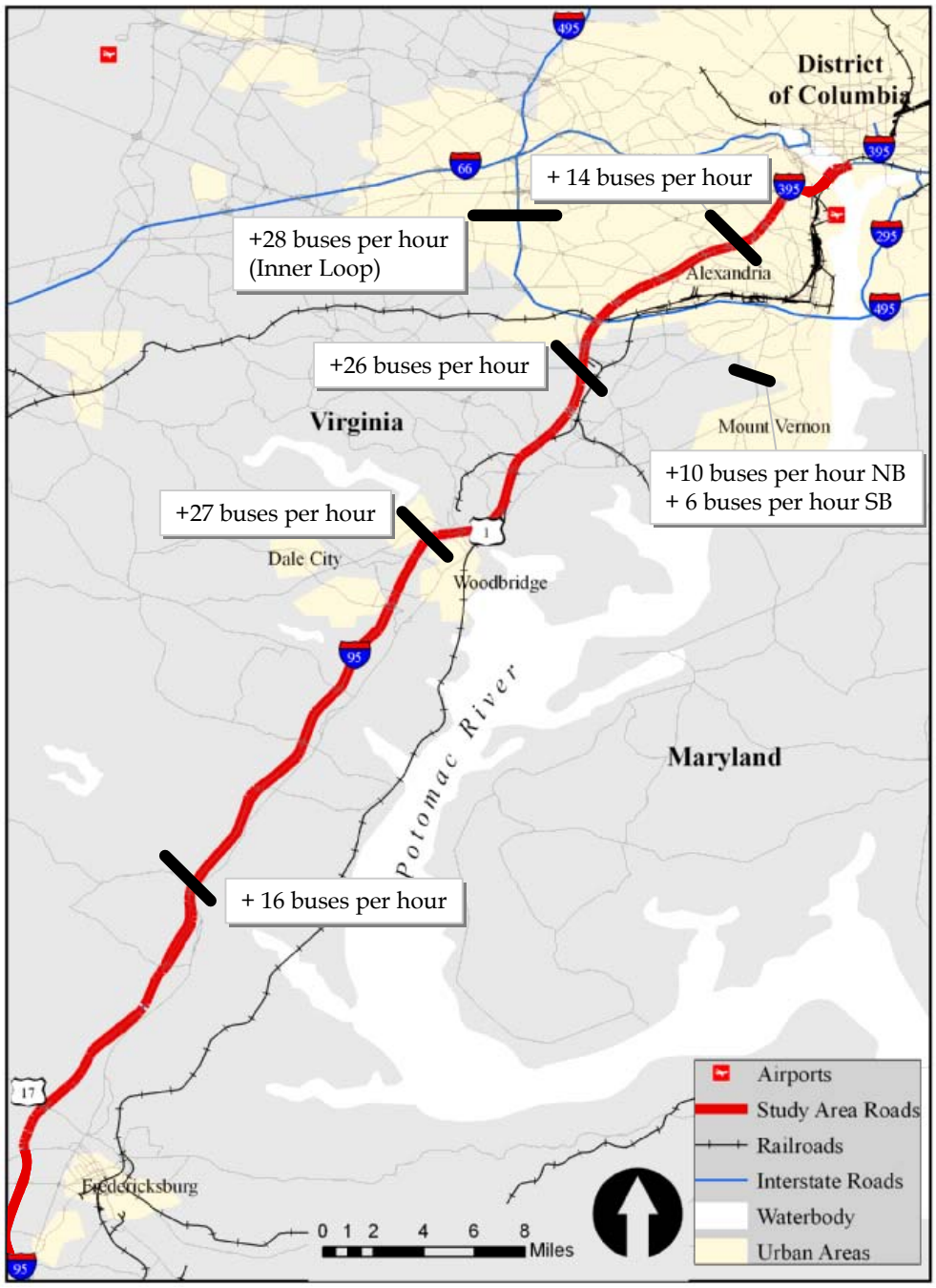


**Figure 2-14. Increase in Bus Service from 2005 to 2030 – AM Peak**




Source: MWCOG/TPB Travel Forecasting Model V2.1D#50 2006 CLRP FY 2007 to 2012 TIP.

# 3.0 Market Research

This section describes the market research conducted as part of the I-95/I-395 Transit/TDM Study.

## *3.1 Market Research Objectives*

As part of the study, market research was conducted to:

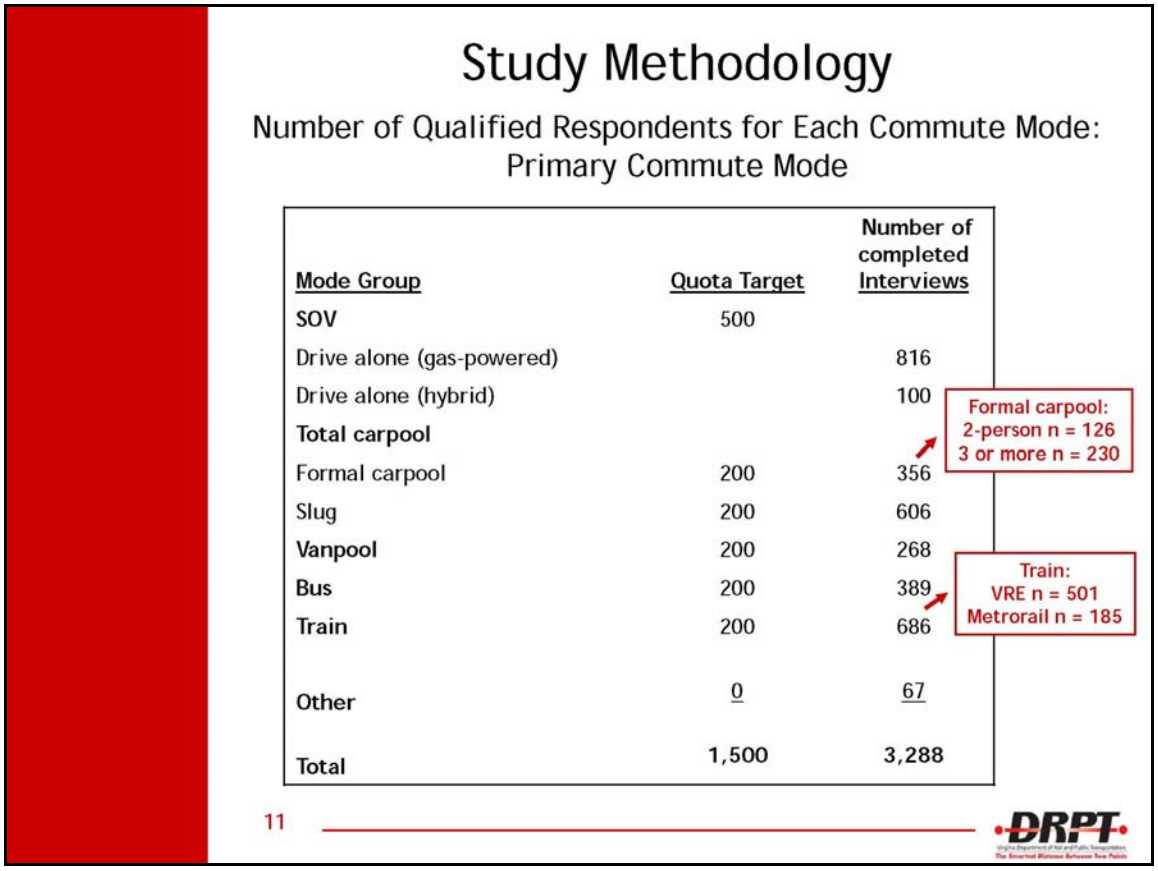
- Profile current travel patterns by modes on the I-95/I-395 corridor;
- Measure the current level of awareness, familiarity, and beliefs regarding HOT Lanes;
- Assess the propensity of commuters to change their commute behavior in response to HOT Lanes availability;
- Identify the relative appeal of specific enhancements and programs (transit/TDM alternatives) needed to increase the likelihood of using non-SOV modes; and
- Assess the relative impact of alternatives to help calibrate subsequent modeling activities.

## *3.2 Study Methodology*

The study was conducted through an on-line survey which was developed with input from the TAC members. The survey questionnaire included elaborate skip patterns to accommodate multiple modes and origin-destination (O-D) patterns. The questionnaire was comprised of scaled attitude and opinion questions, open-ended questions, and choice experiments, where additional HOT lanes price points and time savings scenarios were tested.

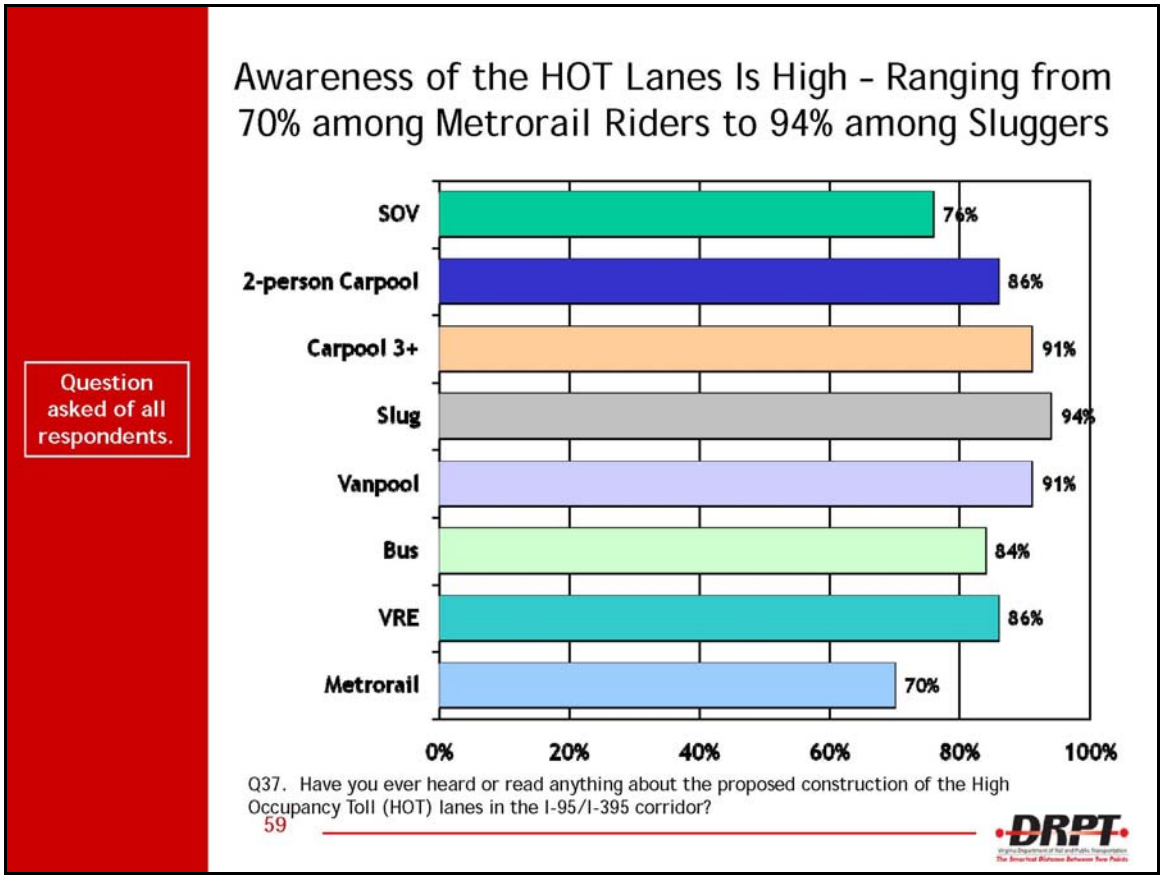
In order to qualify for this study, respondents had to commute to work or school north along the I-95/I-395 corridor during morning peak travel times, and reside in a predetermined study area defined by zip codes. The sample consists of commuters across a variety of transportation modes, including SOV (gasoline engine and hybrid), formal carpool, vanpool, slug, commuter bus, and VRE/Metrorail. Some 75,000 postcards were sent to targeted ZIP codes within the study corridor and additional people were contacted via targeted e-mail lists. A sample size quota of 200 was targeted for each transportation mode with the exception of SOV commuters, which had a sample quota of 500. Nearly 3,300 respondents were obtained across all of the targeted populations (see Figure 3-1).

**Figure 3-1. Sample Sizes**



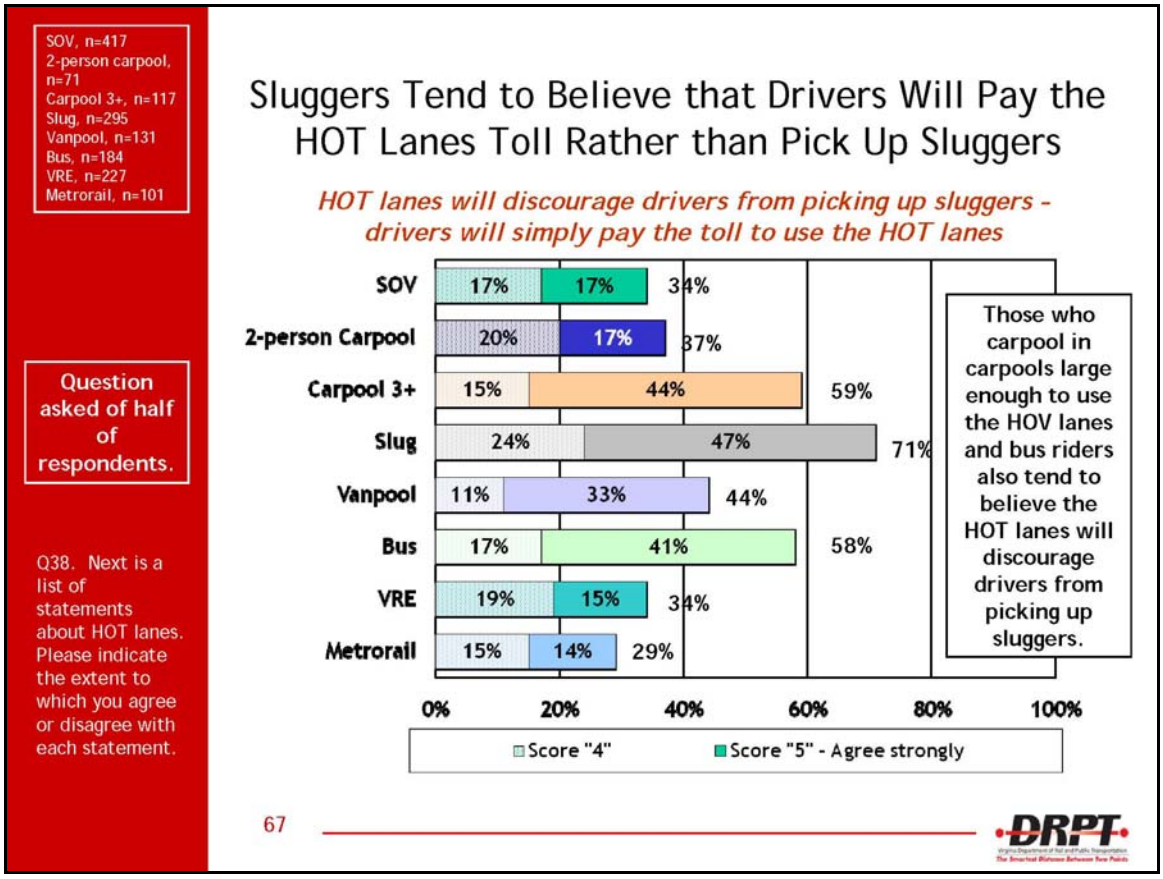
The survey showed that awareness of the HOT lanes in the corridor is high. The lowest level of awareness is posted at 76 percent among SOVers. Nearly all sluggers (94 percent) are aware of the proposed HOT lanes (see Figure 3-2).

## Figure 3-2. Awareness of the HOT Lanes



It was found that sluggers are especially likely (71 percent) to believe that HOT lanes will discourage drivers from picking up sluggers (see Figure 3-3). However, as highlighted in Figure 3-4 and Figure 3-5, most commuters say they would not change their commute in any way when the HOT lanes are open and functional. Among SOVs, 53 percent reported they would not change their commute in any way. Figure 3-5 provides a summary of responses for carpoolers, which are similar to other non-SOV mode users (81 percent of all carpoolers, 82 percent of sluggers, 95 percent of vanpoolers, 91 percent of bus riders, and 86 percent of train riders). Results for all modes are contained in Appendix C. The implication of this finding is that while concern seems to be high in the corridor, the abandonment of slugging would not be a likely outcome of the HOT lanes project.

## Figure 3-3. Opinion on HOT Lanes Impact to Sluggers




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**Figure 3-4. Stated HOT Lane Usage Intentions of SOV Users**

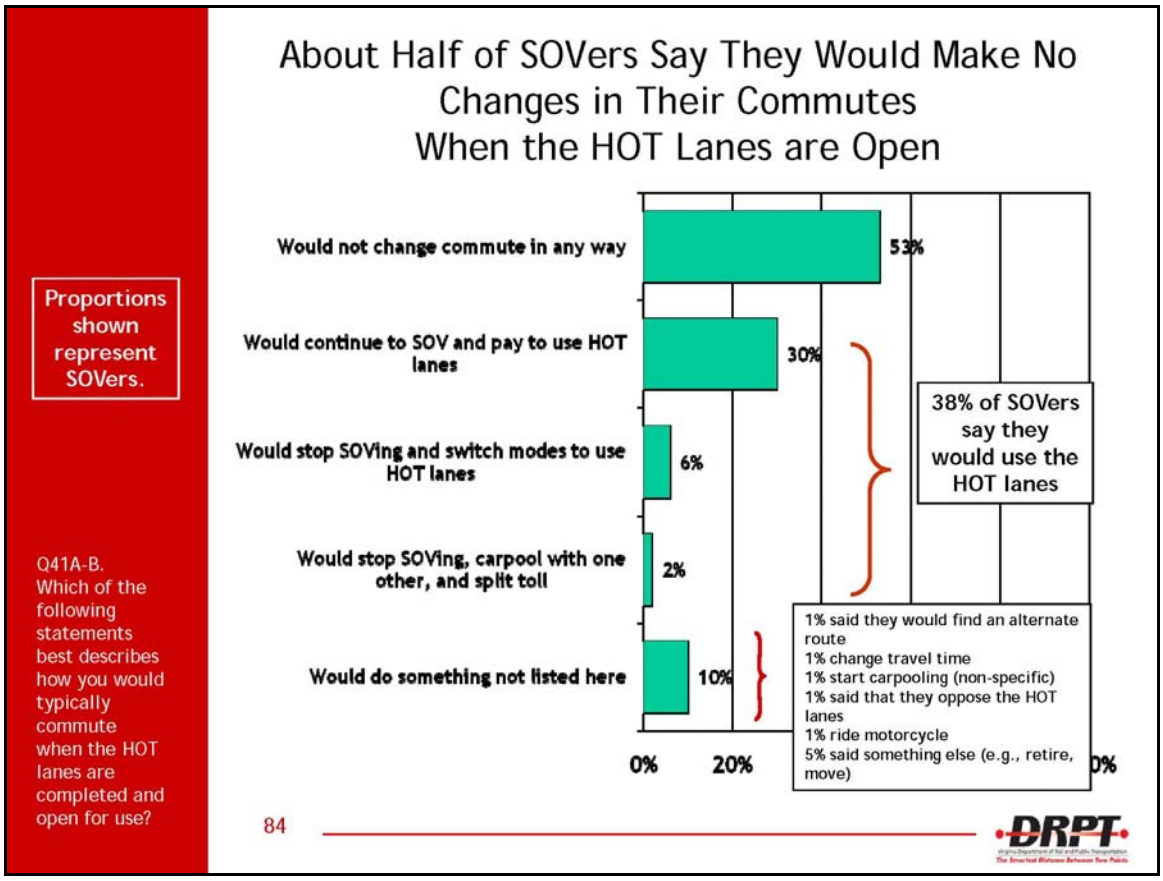
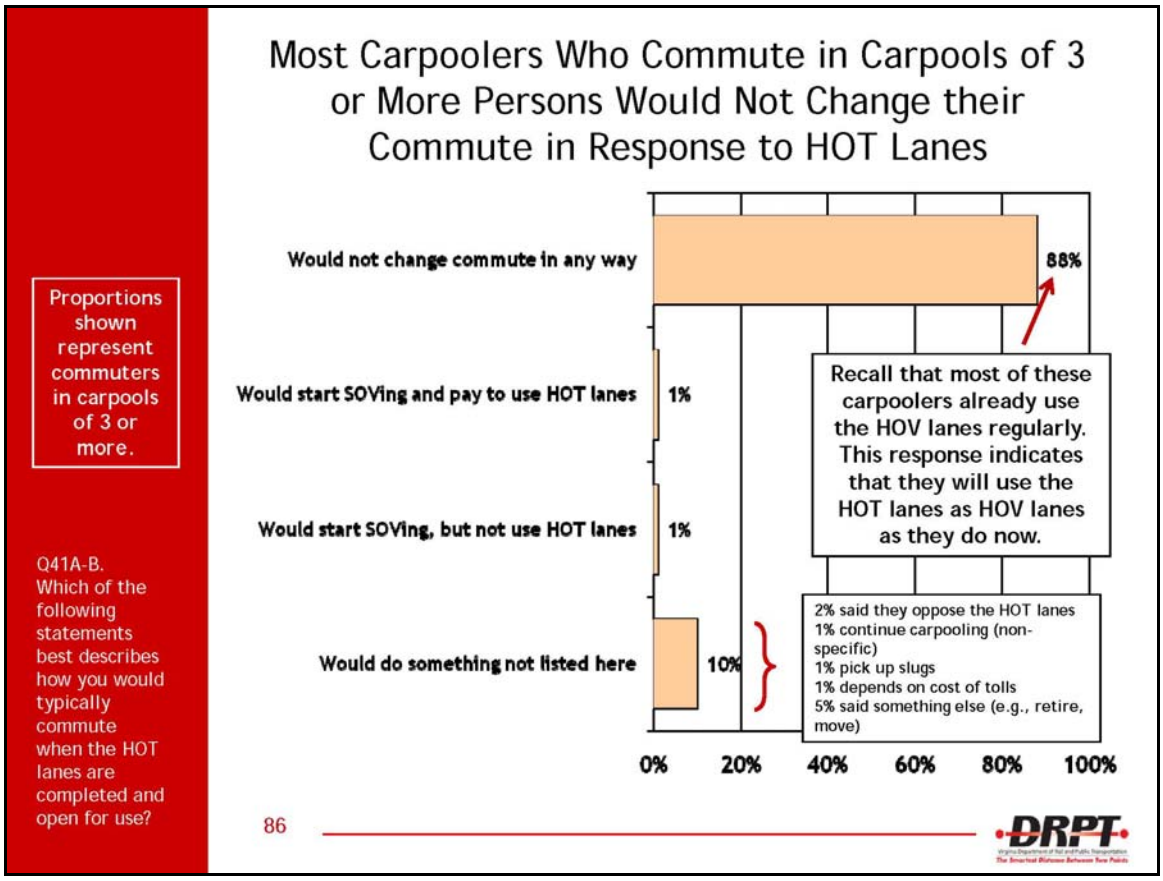
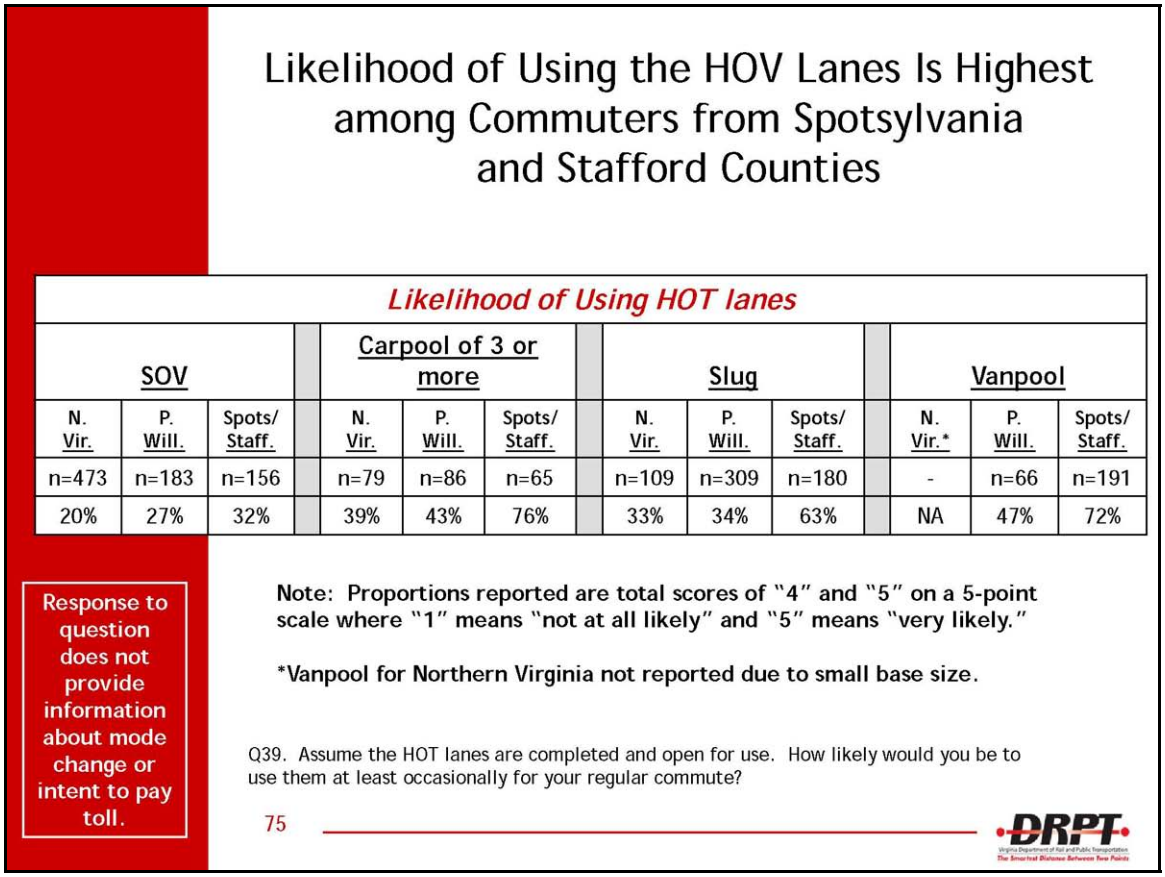


**Figure 3-5. Stated HOT Lane Usage Intentions of Three-Person Carpoolers**




Another finding from the survey is that the likelihood of using HOT lanes is highest among commuters who travel the farthest in the corridor (i.e., from Spotsylvania, Stratford, and Prince William Counties).

**Figure 3-6. Likelihood of Using HOV Lanes**



Likelihood of Using the HOV Lanes Is Highest among Commuters from Spotsylvania and Stafford Counties

*Likelihood of Using HOT lanes*

| SOV | | | Carpool of 3 or more | | | Slug | | | Vanpool | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N. Vir. | P. Will. | Spots/ Staff. | N. Vir. | P. Will. | Spots/ Staff. | N. Vir. | P. Will. | Spots/ Staff. | N. Vir.* | P. Will. | Spots/ Staff. |
| n=473 | n=183 | n=156 | n=79 | n=86 | n=65 | n=109 | n=309 | n=180 | - | n=66 | n=191 |
| 20% | 27% | 32% | 39% | 43% | 76% | 33% | 34% | 63% | NA | 47% | 72% |

Response to question does not provide information about mode change or intent to pay toll.

Note: Proportions reported are total scores of "4" and "5" on a 5-point scale where "1" means "not at all likely" and "5" means "very likely."

*Vanpool for Northern Virginia not reported due to small base size.

Q39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute?

75

DRPT

A detailed complete presentation of information on the survey, findings, and conclusions is presented in Appendix C.

## *3.3 Choice Experiment Background*

As an important part of the HOT lane survey, a set of choice experiments were presented to each respondent. These experiments were designed to understand respondent's willingness to pay for the time savings associated with the HOT lanes and the propensity to switch modes in the face of a new choice option.

At the summary level, it was found that some SOV commuters (<30 percent) were willing to pay for the time savings associated with the HOT lanes, but the cost was a significant influence on this response. On the other hand, very few current non-SOV commuters (<10 percent) state an interest in switching to pay (including current slug drivers) even at lower prices. This finding suggests stability in the current transit and shared ride markets in the corridor and comports with findings suggested by the travel demand forecasting in Section 5.0.

For the choice experiments, each respondent was shown an amount of time savings, varying from 5 to 20 percent of their total travel time, and a randomly generated cost of $0.08/minute to $0.50/minute (shown to the respondent as a total cost, e.g., $4.50). For existing transit and shared ride users, the amount of time savings shown was capped so as not to be unrealistic.

Given the minutes saved and the total cost shown, respondents were asked to choose their mode of travel.

The choice options for current drive-alone respondents were: drive alone in the HOT lanes and pay the toll; switch to an HOV mode to use the HOT lanes for free; carpool with one other person and split the HOT lane toll; not change their behavior (continue to drive alone in the free lanes); or something else. Non-drive-alone respondents had the choices of driving alone and paying the HOT lane toll, driving alone in the free lanes, not changing their current mode, or something else. If a current drive-alone respondent said they would switch to an HOV mode, they were then asked to choose from the following list: carpool, become a slug driver, become a slug passenger, vanpool, ride the bus, ride a train, or other.

The survey results used in this analysis included 9,858 records, 3,835 of which were currently drive-alone respondents, and 6,023 currently non-drive-alone respondents. It should be noted that each respondent accounts for three or four records, depending on their current mode choice.

## *3.4 Choice Experiments Analysis*

The following analysis considers all of the respondents from the choice survey exercises. Figure 3-7 shows the percentage of respondents who chose to pay the toll over all free modes at various levels of the price per minute of time savings. The price per minute of time savings was obtained by dividing the total time savings shown to the respondent by the total price shown. This was done to normalize the data in respect to travel time. In Figure 3-7, the "Not Pay" option includes all other mode choices, such as driving in the free lanes, transit, HOV 3+, etc. If a respondent currently uses a qualifying shared ride mode, a "Not Pay" choice would be to continue to use their current mode.

Figure 3-7 only shows the percentage of each price category choosing to pay, while Table 3-1 presents the percentage that each price category represents in the total population of survey respondents.

### Table 3-1. Percentage of Survey Respondents in each Price Per Minute of Time Savings Category

| | Price per Minute of Time Savings | | |
|---|---|---|---|
| | **<$0.21** | **$0.21-0.35** | **$0.36-0.50** |
| Pay to Drive Alone | 4.4% | 2.9% | 1.7% |
| Not Pay (Any Free Mode) | 26.1% | 33.0% | 31.9% |
| **Total** | **30.5%** | **35.9%** | **33.6%** |

Figure 3-8 shows the results of a binary choice model estimated from the survey data, which is the probability that a driver will choose to pay the toll to drive alone given the price per minute saved of time savings. As expected, there is a decrease in willingness to pay with the increased price per minute of time savings. The details of the binary choice model can be found in Table 3-2.

**Figure 3-7. Percentage Choosing to Pay Based on the Price Per Minute of Time Savings**

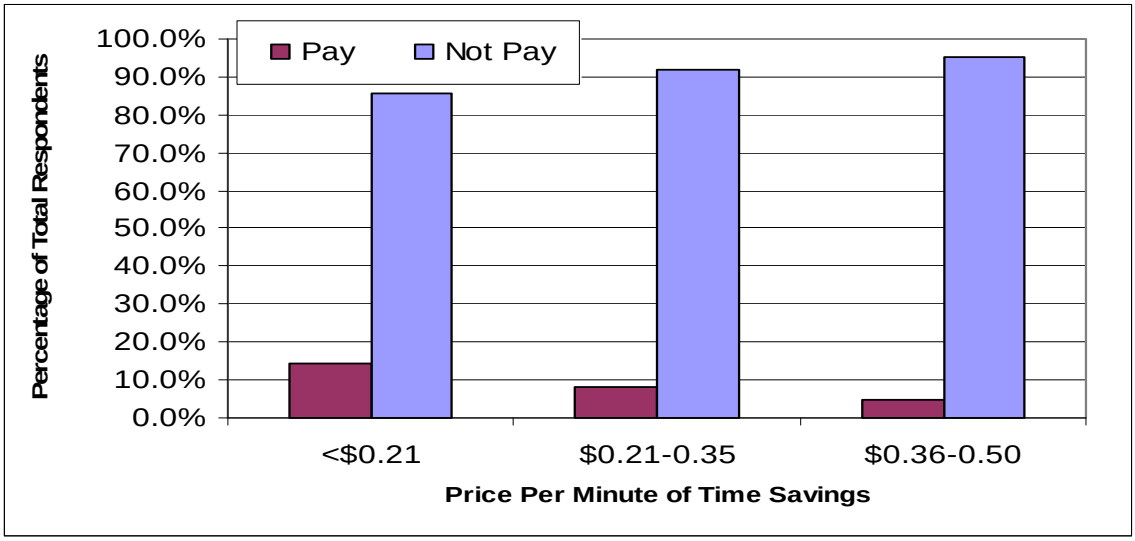



**Figure 3-8. Probability of Paying Based on the Price Per Minute of Time Savings**



## Table 3-2. Probability of Paying at Price Per Minute of Time Savings – Binomial Logit Choice Model

| Parameter | Estimate | Standard Error | T-Stat | Chi-Square |
|---|---|---|---|---|
| Intercept | -1.1921 | 0.0819 | -14.56 | 211.7225 |
| Benefit | -4.1519 | 0.3013 | -13.78 | 189.9337 |

Tables 3-3 and 3-4 show the percentage of mode choice in each price per minute of time savings category relative to the total population of drive-alone survey respondents. Figures 3-8 and 3-9 differ in that they show the percentages of each mode choice in the price category relative to that price category only.

## Table 3-3. Percentage of Current Drive-Alone Survey Respondents in Each New Mode Choice Category

| | Price Per Minute of Time Savings | | |
|---|---|---|---|
| | **<$0.21** | **$0.21-0.35** | **$0.36-0.50** |
| Drive Alone Free (General Lanes) | 20.3% | 25.8% | 24.4% |
| HOT Free | 2.9% | 3.4% | 2.3% |
| Split Toll (HOV-2) | 1.0% | 0.8% | 0.8% |
| Drive Alone Pay (HOT Lanes) | 8.7% | 6.0% | 3.5% |
| **Total** | **32.9%** | **36.1%** | **31.0%** |

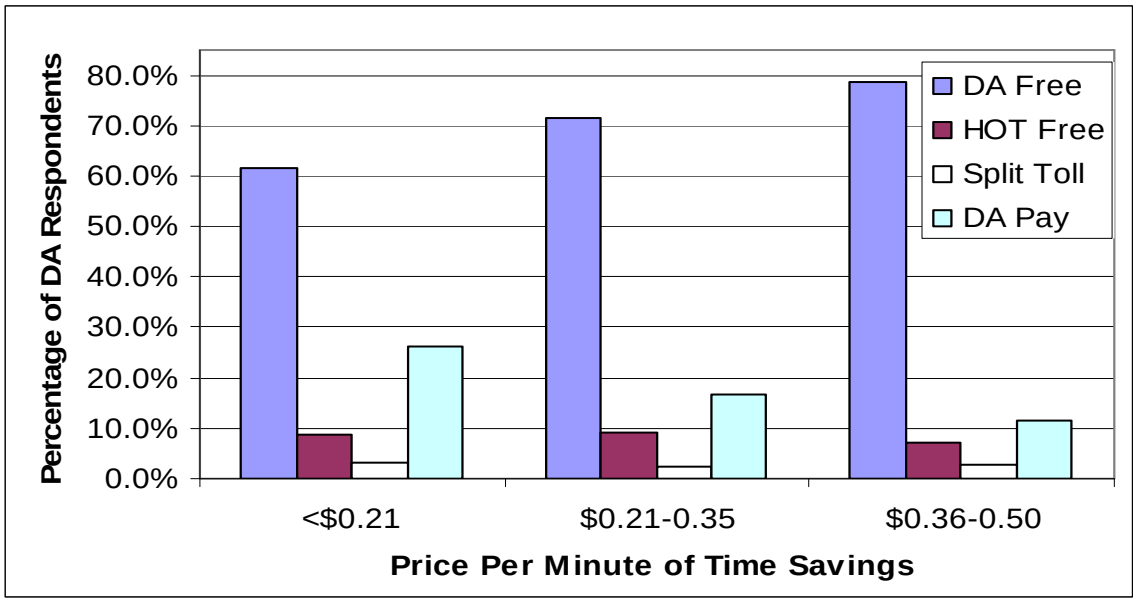
## Table 3-4. Percentage of Current Non-Drive-Alone Survey Respondents in Each New Mode Choice Category

| | Price Per Minute of Time Savings | | |
|---|---|---|---|
| | **<$0.21** | **$0.21-0.35** | **$0.36-0.50** |
| Drive Alone Free (General Lanes) | 0.6% | 0.9% | 0.9% |
| No Change | 26.3% | 33.6% | 33.6% |
| Drive Alone Pay (HOT Lanes) | 2.2% | 1.3% | 0.7% |
| **Total** | **29.1%** | **35.7%** | **35.1%** |

Figures 3-9 and 3-10 show the survey results in terms of the respondents' future mode choice given the opening of the HOT lanes, split into currently drive-alone and currently non-drive-alone respondents, respectively, as they were shown different choices in the experiment. An interesting aspect of the drive-alone respondents is that a very small percentage of the respondents indicate they would switch to HOV-2 in order to split the toll price. Also of interest is that the percentage of drivers switching to pay for the HOT lanes relative to switching to an HOV mode is greater for

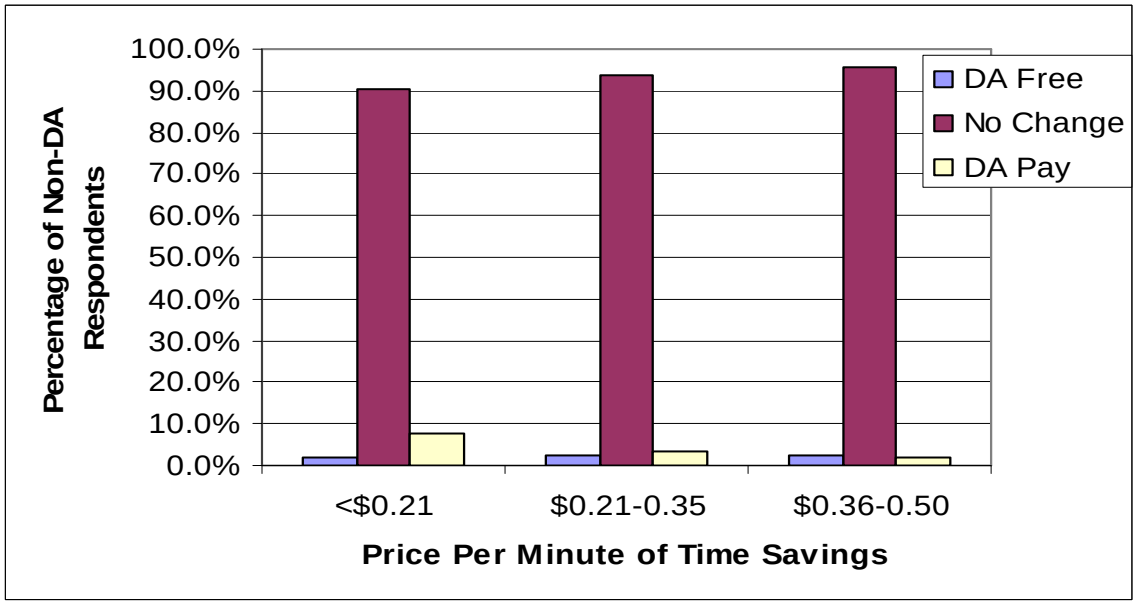
all price per minute time savings categories. Figure 3-10 indicates that most respondents who currently use a non-drive-alone mode will maintain their current non-drive-alone mode.

**Figure 3-9. New Mode Choice of Current Drive-Alone Respondents Based on the Price Per Minute of Time Savings**




Note: DA = Drive Alone

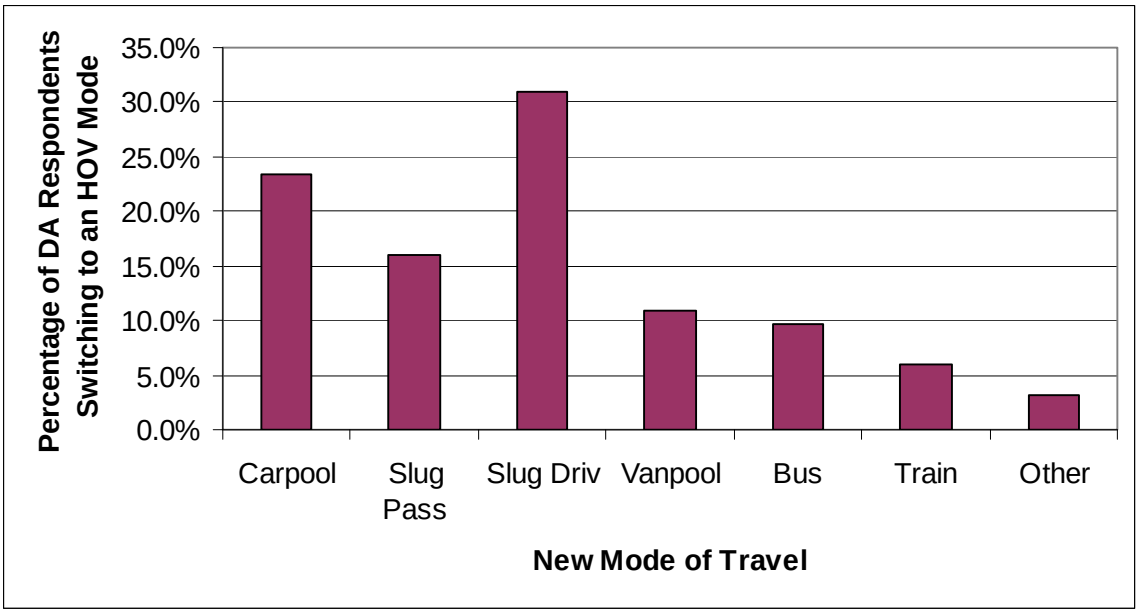
**Figure 3-10. New Mode Choice of Current Non-Drive-Alone Respondents Based on the Price Per Minute of Time Savings**




Note: DA = Drive Alone

Figure 3-11 displays the mode choice of current drive-alone respondents who chose an HOV mode. It should be noted that this is a small subset of the total respondents, accounting for 8.3 percent of drive-alone respondents and 3.2 percent of all respondents. According to the survey results, the largest switch is to slugging, with a combined total of 47 percent of those drive-alone respondents choosing to switch to an HOV mode.

**Figure 3-11. Mode Choice of Current Drive-Alone Respondents Who Switch to an HOV Mode**




## *3.5 Sources of Uncertainty*

Survey data is very useful in obtaining patterns and indications of human behavior, but all survey data has uncertainty, as human subjects introduce variability through levels of understanding, personal agendas, etc. Some potential confounding influences at work in the survey responses could be that respondents chose "No Change" because they did not believe that their destination could be reached with the facility, or they did not believe that they could achieve the time savings presented to them. While information was presented to the respondents prior to the choice experiments pertaining to the toll lanes and their operation, it is impossible to control what other information or misinformation the respondent had previously received, which also could impact their response.

## *3.6 Appendix*

The market research PowerPoint presentation appears in Appendix C, detailing the research methodology, findings, and conclusions.

# 4.0 Definition of Tiered Transit/TDM Alternatives

This section describes the tiered transit/TDM alternatives and refined alternatives for 2015 and 2030 and the process used to develop them. Broadly speaking, the development process consisted of a review and analysis of the market projections and planned transit improvements in the I-95/I-395 corridor.

## *4.1 Transit Alternative Framework*

The development of alternatives was a detailed process that involved substantial coordination with and consensus among the TAC members. First, overall guiding objectives were established. Second, key assumptions and propositions were outlined. Third, the specific approach to defining the transit and TDM alternatives was set forward.

### 4.1.1 Goals and Objectives

The first stage of the alternatives definition process consisted of establishing the objectives that would be used to guide the overall process. The objectives that guided the definition and analysis of the transit/TDM alternatives are as follows:

- Preserve and increase the transit/HOV capacity, use, and operational efficiency in the managed lanes and in the corridor;
- Increase transit level of service through improvement of coverage in higher density areas and service improvements to major activity centers and destinations;
- Preserve transit and HOV ridership while implementing HOT lanes with the implementation of improvements that help maintain current market share for transit, carpools, and vanpools; and
- Utilize new HOT lane features to attract new transit and HOV riders by using a corridor management approach to improve existing service and serve new markets.

### 4.1.2 Key Assumptions

The second stage of the alternatives definition process involved determining the key assumptions and propositions that served as a framework for detailed definition and design of the three "tiered" alternatives. These included funding assumptions, proposed categories of alternatives, and considerations such as coordination with stakeholders. The resulting list of key propositions and assumptions that were agreed to included the following:

- Transit service improvements should be demand driven, i.e., alternatives should be built from existing service levels and used to meet forecasts of increased travel demand, with reference to adopted plans as appropriate; and should incorporate reasonable assumptions about cost increments and revenues;
- Investment levels committed from the earlier 2007 MWCOG I-95/I-395 HOT lanes project CLRP submittal represent a financial "placeholder" with respect to expanding/improving transit services. Transit services from this earlier submittal may or may not be incorporated into the specific transit plan proposed by this study;

- Alternatives will include, at a minimum, increments of additional cost/investment, incorporating the assumed I-95/I-395 HOT Lane Project contribution estimated at $195 million. The funding assumption was given by VDOT and the Fluor-Transurban team to the TAC. This is the amount of money projected to be available from the Project for additional transit/TDM projects;

- Assumptions about the availability of funding from specific Federal formula and discretionary programs should be arrived at and agreed to by the TAC independent of the earlier HOT lane MWCOG CLRP proposal, e.g., the likelihood of significant additional Federal discretionary funding over and above the amount that currently is committed to the region is an open question;

- Added increments of investment should be dedicated to improvements in publicly operated transit services and TDM services;

- Alternatives should be defined as those operating over major facilities in the corridor, e.g., I-95, I-395, I-495, U.S. 1, VRE, Metrorail, Amtrak, plus related feeder services;

- Where new access is proposed, a portion of projected investment should be considered to support related feeder services at major destinations, as appropriate;

- Funding related to the HOT lane project should be reserved for facility and system expansion directly related to service level increases associated with the project, i.e., this funding should not replace funds for projects or activities that already are planned or programmed;

- Alternatives should be defined to indicate changes in service levels by type of transit service and TDM programs, as well as by specific provider; and

- The design of service alternatives will be informed by stakeholder input and the results of survey data analysis.

The agreement of the TAC on these key propositions and assumptions for alternatives development permitted the detailed definition and design of the tiered alternatives to proceed.

### 4.1.3 Detailed Approach to Planning Transit/TDM Alternatives

The basic market of transit/TDM users in the corridor consists of commuters whose trip would benefit from HOT lane improvements. These commuters are primarily long-distance travelers from Fredericksburg, Stafford, Prince William, and Springfield who commute to the Washington, D.C./ Arlington core, but with the new egress locations along the facility some new markets also become important.

Existing transit services already provide reasonably good coverage in areas with large numbers of transit/HOV trips into the Washington, D.C./Arlington core. The tiered alternatives in this study were planned to enhance this coverage or the existing levels of service.

Table 4-1 summarizes potential transit service concepts by study subarea, which follow from existing conditions and plans as well as new transit opportunities created by the HOT Project, including new access points and new transit destinations.

## Table 4-1. Potential Transit Service Concepts by Study Subarea

| Area | New Transit Opportunities Created by HOT Project (New Access Points) | New Transit Markets/ Trip Destinations | Potential Transit Improvements Affecting the Subarea |
|---|---|---|---|
| Alexandria/ Arlington Areas | New transit opportunities may be created by adding access points to Seminary Road, Shirlington, and the HOT lanes on the beltway. | New transit markets will be opened up by creating new transit access to activity centers at Mark Center, Bailey's Crossroads, Skyline, Shirlington, Merrifield, and Tysons. | Serving Trips Originating in the Area:<br>• Express bus services from the area into D.C. (new service or revision to existing WMATA service).<br>Serving Destinations in the Area:<br>• New PRTC or Fredericksburg/Stafford commuter services directly to these activity centers; and<br>• Shuttle service from VRE/Metrorail/HOV commuter buses to new activity centers in Northern Virginia. |
| Springfield/ Fairfax Areas | New transit opportunities may be created by adding access points at Lorton, as well as the new access points in north. | New transit markets will be created with connections to Ft. Belvoir and the Engineer Proving Ground (EPG). | Serving Trips Originating in the Area:<br>• New commuter bus services from the area into D.C./Arlington core – possibly neighborhood shuttles with express bus; and<br>• Shuttle bus service from area to VRE for commutes to downtown Alexandria and/or D.C.<br>Serving Destinations in the Area:<br>• New PRTC or Fredericksburg/Stafford commuter service to Ft. Belvoir and/or EPG;<br>• Shuttle bus service from Metrorail/VRE/Amtrak/HOV commuter buses to Ft. Belvoir and the EPG; and<br>• Modifications to current PRTC or private commuter services to add commuter bus stops at t Ft. Belvoir. |
| Prince William Area | New transit opportunities may be created by adding access points at Route 123 and Potomac Mills/Dale Boulevard, as well as the access points north at Lorton and Alexandria/Arlington. | New transit markets will be created among northbound commuters from the Woodbridge/Dale City area, as well as among commuters from the south traveling to jobs in the Woodbridge/ Dale City activity center. | Serving Trips Originating in the Area:<br>• Additional commuter bus services from the area into D.C./Arlington core – could be increased frequency on existing PRTC routes or new routes – continue concept of neighborhood shuttles with express bus.<br>Serving Destinations in the Area:<br>• New Fredericksburg/Stafford commuter service to Woodbridge/ Potomac Mills/Dale City. |

## Table 4-1. Potential Transit Service Concepts by Study Subarea (continued)

| Area | New Transit Opportunities Created by HOT Project (New Access Points) | New Transit Markets/ Trip Destinations | Potential Transit Improvements Affecting the Subarea |
|---|---|---|---|
| Prince William Area (continued) | | | Service Both Trip Origins and Destinations:<br>• Modifications to current PRTC or private commuter services to add commuter bus stops at the Route 123 and Potomac Mills access points; and<br>• Shuttle service from VRE/Metrorail/HOV commuter buses to Woodbridge/Potomac Mills/Dale City. |
| Stafford and Fredericksburg Areas | Improvements to transit services will be created by adding access points in Garrisonville/Aquia and Fredericksburg. | The area has an unserved transit market for local bus services from the communities to the private commuter bus pick-up points (not necessarily attributable to HOT lanes). | Serving Trips Originating in the Area:<br>• Modifications to current Martz/Quicks private commuter services to add commuter bus stops at new access points;<br>• Additional commuter bus services from the area into D.C./Arlington core – could be increased frequency on existing Quicks/Martz or new routes;<br>• Increased hours on FRED bus (span of service) to meet private commuter bus locations;<br>• New neighborhood circulators to connect to VRE and/or private commuter buses to north; and<br>• Extension of current Martz/Quicks private commuter routes to circulate in the neighborhoods. |
| Corridor-wide | All of Above | All of Above | • Enhanced TDM measures are needed throughout the region. Creation of new access points for car and van pools will improve these options;<br>• Enhanced VRE/Amtrak;<br>• Metrorail line extension to Potomac Mills;<br>• BRT along Route 1;<br>• In-line transit stations at major activity centers along the HOT lanes; and<br>• Park-and-ride improvements to support transit/HOV. |

## *4.2 Summary of Tiered Transit/TDM Alternatives*

Three levels of investment were selected as target cost ceilings for the set of tiered transit/TDM alternatives, including: $250 million; $500 million; and unconstrained. With these limits in mind, the set of alternatives were detailed. In particular:

- To further promote carpooling and vanpooling (and slugging), additional TDM programs and services were proposed;
- Bus transit options currently are constrained by limitations in the access/egress points on HOV lanes. New access points accommodate new transit alternatives;
- Existing routes were revised to serve new markets, e.g., through minor changes to route alignments;
- New commuter and express bus services were created in the corridor;
- New local feeder bus service was proposed to connect commuters to VRE/Amtrak/Metrorail or commuter bus;
- New neighborhood circulators/shuttles with commuter bus were developed. These buses provide local bus service to residential neighborhoods then continue as commuter buses to Northern Virginia and Washington, D.C.; and
- Rail and other fixed facilities were created. Potential projects include the extension of Metrorail to Potomac Mills, enhancements to VRE/Amtrak, and BRT in-line transit stations at major activity centers along the HOT lanes (to allow buses to stop with minimal delay).

The process of developing the tiered transit/TDM alternatives was iterative. Qualitative assessments were performed with the help of the TAC to arrive at decisions as to the direction in which to take the alternatives. A detailed description of the elements of the final tiered transit/ TDM alternatives is presented in Table 4-2.

The final Baseline scenario consisted of the following elements:

- Existing transit/TDM service levels;
- CLRP programmed projects (2030); and
- Proposed HOT lane project improvements.

The Low Alternative scenario consisted of an approximate cost of $250 million, a 100 percent increase over existing bus service, and expanded VRE capacity. It was defined as the Baseline Scenario plus:

- Bus service modifications (frequency, routes);
- New express bus routes;
- VRE service improvements (eight-car trains in the peak, expand four-station platforms);
- Improved shuttle services, transit centers, stations, and park-and-ride facilities;
- TDM program improvements (marketing, signage, carpool/vanpool incentives, rideshare operational support); and

- Park-and-ride improvements.

The Medium Alternative scenario had an approximate cost of $500 million and represents a 145 percent increase over existing bus service, introduction of elements to bring a BRT system to the corridor, and a 45 percent increase in VRE service. It was defined as the Low Alternative scenario (which includes the Baseline improvements) plus:

- Bus Rapid Transit System (including five in-line stations);
- Increase VRE/Amtrak Fredericksburg Line trains (increase from 14 to 20 trains and increase storage);
- Three new transit centers;
- TDM improvements (vanpool/telework financial assistance, rideshare program operational support); and
- Park-and-ride improvements.

The High Alternative scenario had an unconstrained cost and represents a 145 percent increase over existing bus service, a 130 percent increase in VRE service, and a Metrorail extension. It was defined as the Medium-Alternative scenario (which includes the Low and Baseline improvements) plus:

- Metrorail extension (Franconia-Springfield to Potomac Mills Mall);
- Increase VRE/Amtrak Fredericksburg Line trains (increase from 20 to 32 trains, two new stations, storage);
- TDM improvements (vanpool financial assistance, statewide guaranteed ride home program, pilot facilitated rideshare system); and
- Park-and-ride improvements.

## Table 4-2. Tiered Transit/TDM Alternatives

| Tier | Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|---|
| **Service Modifications** | | | | |
| L | Arlington/ Alexandria/D.C. | WMATA | **WMATA 7B –** Decrease headway on 7B from 35 minutes to 17/18 minutes by adding one bus. | *Weekdays only – 6:12 a.m. to 8:50 a.m. and 4:32 p.m. to 7:17 p.m.* |
| L | Prince William | PRTC | **OmniRide North Route 1 –** Increase Frequency on OmniRide North Route 1 by adding additional trips in peak-period, one in midday and late evening. | *Weekdays only - add six additional trips per peak-period, one in midday and one in late evening. Assume each trip takes 100 revenue minutes.* |
| L | Prince William | PRTC | **OmniLink Route 1 –** Extend OmniLink Route 1 to Ft. Belvoir during peak periods. | *Weekdays only - Extends route seven miles – 4:00 a.m. runs and 4:00 p.m. runs would be extended. Assume 30 minutes additional revenue hours per run.* |
| L | Corridor-wide | VRE | **VRE Train Size –** Increase train size so three of the Fredericksburg trains have eight cars and four have six cars. | *Assumes VRE's planned expansion to 36 daily trains is funded and that the existing VRE locomotive fleet will be funded and in place by 2015 and the new locomotives are capable of pulling eight car consists. Also assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would not need additional overnight storage at Crossroads Yard/Fredericksburg or improvements for D.C. or overnight storage under this scenario.* |
| M | Arlington/ Alexandria/D.C. | ART | **ART 41 –** Add 5th bus to ART 41 on weekdays. | *Weekdays only - 6:30 a.m. to 8:30 p.m. Currently, every 15 minutes - increase to every 12 minutes.* |
| M | Prince William | PRTC | **PW MetroDirect –** Modify Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours. | *Weekdays only - involves eight peak trips (4:00 a.m. and 4:00 p.m.). 5:25 a.m. to 8:15 a.m. and 4:35 p.m. to 7:30 p.m. Assume an additional 30 minutes for circulation.* |
| M | Prince William | PRTC | **Dale City-Navy Yard –** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds two additional trips per peak-period. | *Weekdays, peak-period only - involves 12 peak trips (6:00 a.m. and 6:00 p.m.). 4:38 a.m. to 8:27 a.m. and 3:37a.m. to 8:00 p.m. Assume two additional trips per peak-period at 105 revenue minutes per trip.* |

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|---|
| **New Shuttle/Feeder Bus Services** | | | | |
| L | Fairfax/Springfield | Fairfax Connector | **Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttle –** New shuttle service between the Springfield Metro-EPG/Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway. | *Weekday peak only – 12-minute headways. Distance 15 miles/loop - 36 minutes per loop. Assume one vehicle. May need to adjust depending on access to base.* |
| L | Fairfax/Springfield | Fairfax Connector | **Lorton VRE-EPG-Ft. Belvoir Shuttle –** New "meet the train" shuttle or subscription service between the Lorton VRE Station-EPG/Ft. Belvoir via Telegraph Road, Fairfax County Parkway and Rolling Road/Pohick Road. | *Weekday peak only – timed to meet VRE/Amtrak trains to/from the south (6:00 a.m. and 6:00 p.m.). Distance seven to eight miles/loop – 15 minutes per loop. Assume one vehicle. May need to adjust depending on access to base.* |
| L | Stafford/ Fredericksburg | FRED | **FRED –** Increase Span of service and frequency on selected FRED routes to meet commuter bus - Routes 6, 2, 3, 7, 8, 11, 12, and 15. Extend some. | *Eight routes – three hours added each day.* |
| **New Bus/Rail Services** | | | | |
| L | Arlington/ Alexandria/D.C. | ART | **Shirlington-Rosslyn –** New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area). | *Weekdays only – assumed 20-minute headways in peak only. Distance six miles – assume 20 minutes.* |
| L | Fairfax/Springfield | WMATA | **Lorton/Laurel Hill-EPG-Pentagon –** New express bus route from Lorton - EPG-Pentagon. Proposed at 15/30 minute headways in 2015 and 10/15 in 2030 – the route should serve EPG southbound in the morning and northbound in the evening. | *Weekdays only – assumed 15-minute headways in peak only (2015 proposal). Distance 15 miles – assume 45 minutes.* |
| L | Prince William | PRTC | **Dale City/Lake Ridge-EPG –** New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30-minute headway). | *Weekday 30-minute headways peak hour only. Distance 15 miles – assume 30 revenue minutes per trip.* |
| L | Prince William | PRTC | **Woodbridge-EPG –** New OmniRide route from Woodbridge to EPG (proposed 30-minute headway peak only). | *Weekday 30-minute headways peak hour only. Distance 10 miles – assume 20 revenue minutes per trip.* |
| L | Stafford/ Fredericksburg | FAMPO | **Fredericksburg-EPG/Ft. Belvoir –** New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir. | *Weekday 30-minute headways peak hour only. Distance 40 miles – assume 1.5 revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|---|
| **New Bus/Rail Services (continued)** | | | | |
| L | Stafford/ Fredericksburg | FAMPO | **Fredericksburg-D.C. –** New Express/BRT route from Fredericksburg to D.C. core (when combined with Massaponax, service would operate alternating 15 minutes). | *Weekday 30-minute headways peak hour only. Distance 55 miles – assume revenue hours per trip - 12 trips (6:00 a.m. and 6:00 p.m.).* |
| L | Stafford/ Fredericksburg | FAMPO | **Massaponax to D.C. –** New Express/BRT route from Massaponax to D.C. core (when combined with Fredericksburg-D.C. route, service would operate alternating 15 minutes). | *Weekday 30-minute headways peak hour only. Distance 60 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| M | Fairfax/Springfield | WMATA | **Kingstowne-Shirlington-Pentagon –** New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria. | *Weekdays only – 30-minute headways all day – bidirectional.* |
| L<br>M<br>H | Prince William/Fairfax | PRTC | **Woodbridge-Lorton-Tysons Corner and Merrifield –** New OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner. Extend to Merrifield in Medium – peak only. | *Weekdays peak hour only – 45-minute headway in Low; 30 minutes in Medium; and 20 minutes in High.* |
| M | Prince William | PRTC | **Central PW-Pentagon-D.C. –** New OmniRide Route to start near Hoadley Road, run express down PW Parkway to the HOV lanes - Pentagon and D.C. | *Peak hours only – 45-minute headways.* |
| M | Prince William | PRTC | **Central PW-Downtown Alexandria –** New route from Central Prince William County and along I-95 corridor then serving East Eisenhower Valley and Downtown Alexandria west of Washington Street. | *Weekday 45-minute headways peak hour only. Distance 20 miles – assume 45 revenue minutes per trip.* |
| M | Prince William | PRTC | **New OmniRide Express Route from Dale City to Seminary Road Area –** Skyline, Bailey's Crossroads and Mark Center via Seminary Road. | *Weekdays only – peak-period – 45-minute headways serving Seminary Road area – Mark Center, Skyline, and other nearby employment centers – assume four trips in each peak-period.* |
| M | Prince William | PRTC | **New OmniRide Express Route from Lake Ridge to Seminary Road Area –** Skyline, Bailey's Crossroads and Mark Center via Seminary Road. | *Weekdays only – peak-period – 45-minute headways serving Seminary Road area – Mark Center, Skyline, and other nearby employment centers – assume four trips in each peak-period.* |

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|---|
| **New Bus/Rail Services (continued)** | | | | |
| M | Stafford/ Fredericksburg | FAMPO | **Fredericksburg-Tysons Corner –** New express/BRT route from Fredericksburg to Tysons Corner. | *Weekday 30-minute headways peak hour only. Distance 55 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| M | Stafford/ Fredericksburg | FAMPO | **Fredericksburg-Ballston/Rosslyn –** New Express/BRT route from Fredericksburg to Ballston/Rosslyn. | *Weekday 60-minute headways peak hour only.* |
| M | Stafford/ Fredericksburg | FAMPO | **Fredericksburg-Pentagon/Crystal City –** New Express/BRT route from Fredericksburg to Pentagon/Crystal City. | *Weekday 30-minute headways peak hour only. Distance 50 miles – assumed two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| M | Corridor-wide | VRE/Amtrak | Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of six- and eight-car trains. | *Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. May need additional overnight storage at Crossroads Yard/Fredericksburg but would not need additional midday storage at D.C. under this consist mix scenario.* |
| H | Corridor-wide | VRE/Amtrak | Increase number of trains on Fredericksburg Line from 20 to 32 per day (16 North/16 South). Assume mix of six- and eight-car trains. | *Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would also need additional overnight storage at Crossroads Yard/Fredericksburg and more midday storage in D.C.* |
| **Fixed Facilities** | | | | |
| L | Arlington/ Alexandria/D.C. | WMATA | Improvements at **Pentagon Metrorail Transit Center** (additional bus bays, real-time information, traffic circulation/access/egress, security improvements). | |
| L | Fairfax/Springfield | Fairfax | Improvements at **Franconia-Springfield Metrorail Transit Center** (additional bus bays and bus canopies, real-time information, traffic circulation/access/egress, security improvements). | |
| L | Corridor-wide | | **ITS projects** to improve integration of information on HOT lanes/parking lots/bus/rail – NEXT Bus. | |
| L | Corridor-wide | | **Additional park-and-ride lot capacity** at various locations (new and/or existing lots). | |

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H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|---|
| **Fixed Facilities (continued)** | | | | |
| L<br>M<br>H | Corridor-wide | VRE | **Platform Extensions** at selected stations. | *In order for VRE to run eight-car trains, platforms at key stations should be extended – VRE estimate 4 stations needing platform improvements. Can have 8 car trains at short platforms but not optimum.* |
| M | Fairfax/Springfield | Fairfax | **Transit Center** near Ft. Belvoir/EPG. | |
| M | Fredericksburg | FAMPO | **Transit Center** at Route 610. | |
| M | Fredericksburg | FAMPO | **Transit Center** at Massaponax. | |
| M | Corridor-wide | | **In line transit station**s considered along the corridor – four in-line stations included in cost. | *Suggested locations: Seminary Road vicinity, Lorton (included in HOT project cost rather than here), Prince William Parkway, VA Route 610, U.S. 17/ Warrenton.* |
| M | Corridor-wide | VRE | **Overnight Storage in Fredericksburg.** | *With the increase in trains to 20, VRE will need additional storage at Crossroads in Fredericksburg.* |
| H | Fairfax/Springfield | WMATA | **Metrorail Extension** from Springfield to Lorton/Ft. Belvoir. | |
| H | Fairfax/Springfield | WMATA | **Metrorail Extension** from Lorton/Ft. Belvoir to Potomac Mills Mall. | |
| H | Fredericksburg | VRE | **New VRE Station** at Route 17 in Spotsylvania County. | |
| H | Fredericksburg | VRE | **New VRE Station** at Widewater in Stafford County. | |
| H | Corridor-wide | VRE | **D.C. Midday Storage and Overnight Storage in Fredericksburg.** | *When beyond 20 trains a day, VRE will need additional storage capacity in D.C. and Fredericksburg to permit increased service frequency on existing routes.* |
| H | Corridor-wide | VRE | Other Capital Improvements. | *In order to increase VRE above 40 trains/day (both lines), additional improvements are needed; this is being studied/simulated by DRPT. Requirements unknown.* |

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L = Low – Designates program elements present in all three transit/TDM investment scenarios
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H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Program | Description |
|---|---|---|---|
| **TDM Program Elements** | | | |
| L | Corridor-wide | **Carpool Incentives** | *Rewards and incentives for carpoolers.* |
| L | Corridor-wide | **Electronic Toll Transponders for Vanpools** | *Provide free electronic toll transponders to vanpools. (Although vanpools will use the toll lanes for free, this program is included in case some type of verification is needed to determine that the vehicle is a vanpool)* |
| L | Corridor-wide | **Rideshare Program Operational Support** | *Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.* |
| L | Corridor-wide | **TDM Programs Marketing** | *Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs.* |
| L | Corridor-wide | **Vanpool Driver Incentives** | *Provide incentives to get new drivers and retain existing drivers for vanpools.* |
| L | Corridor-wide | **Vanpool Insurance** | *Increase vanpool insurance premium pool buy-down for vanpools.* |
| L | Corridor-wide | **Vanpool Tracking** | *Provide free electronic toll transponders to vanpools.* |
| L | Corridor-wide | **VanStart/VanSave** | *Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.* |

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

## Table 4-2. Tiered Transit/TDM Alternatives (continued)

| Tier | Originating Area | Program | Description |
|---|---|---|---|
| **TDM Program Elements (continued)** | | | |
| M | Corridor-wide | **Capital Cost of Contracting for Vanpools** | *Incentives, IT monitoring and reporting of vanpool mileage, and promotion of capital cost of contracting for vanpools.* |
| M | Corridor-wide | **Telework Program Assistance** | *Financial incentives for employers that start new telework programs at their worksites, funding for home-based equipment costs and consulting support.* |
| H | Corridor-wide | **Capital Assistance For Vanpools** | *Provide financial assistance for the purchase or lease of vans for vanpools.* |
| H | Corridor-wide | **Enhanced Guaranteed Ride Home** | *Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.* |
| H | Corridor-wide | **HOVER Pilot Program** | *HOVER is a facilitated "park and ride-share" system that involves tracking of all participants' usage, and sharing of costs and benefits through a combination of financial and "HOVER Ride Credit" accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150-200 spaces is needed.* |

Tier
L = Low – Designates program elements present in all three transit/TDM investment scenarios
M = Medium – Designates program elements present only in the Medium and High investment scenarios
H = High – Designates program elements present only in the High investment scenario

## *4.3 Refined Alternative*

The consultant team used the travel demand forecasting model to evaluate the relative performance of the service modifications and new services suggested as a part of the tiered alternatives. Results from the travel demand forecasting are presented in Section 5.0.

Based on the forecasting results, the TAC decided to develop a Refined Alternative that would incorporate the most promising projects while maintaining a program cost similar in magnitude to the original Medium Alternative. Table 4-3 provides a detailed description of the resulting Refined Alternative. The following sections provide some additional background on the formulation of the alternative.

### 4.3.1 Refining the Bus Service Elements

Bus service changes and new services were examined in terms of trips per revenue hour to help identify the most promising projects for the Refined Alternative. Services were categorized as poor, marginal, good, or high performers based on this metric. Bus services with fewer than 10 trips per hour were categorized as poor performers and were considered for elimination in the refined alternative. The following bus services fell under this category:

- Franconia-Springfield Metro to EPG/Ft. Belvoir (reverse commute);
- Fredericksburg Internal Shuttles;
- Fredericksburg to Tysons Corner; and
- Fredericksburg to Ballston/Rosslyn.

Bus services with 10 to 20 trips per hour were categorized as marginal performers and were considered for service cuts in the refined alternative. The following bus services fell under this category:

- In the Low Alternative, Woodbridge to Lorton to Tysons Corner (competes with other services along same route – consider operating to Merrifield even in the Low Alternative); and
- Fredericksburg to EPG/Ft. Belvoir (had 6 trips per peak, maybe reduce to 4 trips per peak, have selected Fredericksburg-Washington, D.C. runs stop at Ft. Belvoir, or reconsider with BRAC).

Services with 20 to 100 trips per hour were categorized as good performers and were retained in the refined alternative. The following services fell under this category:

- Lorton VRE-EPG/Ft. Belvoir Shuttle;
- Woodbridge to EPG;
- Dale City/Lake Ridge to EPG;
- Fredericksburg to Washington, D.C.;
- Massaponax to Washington, D.C.;
- Central Prince William County to Pentagon to Washington, D.C.;
- Dale City to Seminary Road area;
- Lake Ridge to Seminary Road area; and
- Fredericksburg to Pentagon/Crystal City.

Services with over 100 trips per hour were categorized as high performers and were retained in the refined alternative with a recommendation to consider increasing service. The following services fell under this category:

- Lorton/Laurel Hill to EPG to Pentagon;
- Kingstowne to Shirlington to Pentagon;
- Shirlington to Rosslyn;
- Central Prince William to Downtown Alexandria; and
- *In Medium and High Alternative* – Woodbridge to Lorton to Tysons Corner to Merrifield (extension to Merrifield opens new market and distinguishes it from other routes).

### 4.3.2 Refining the Rail Service and Other Elements

Service frequency improvements to VRE in the Medium and High Alternatives performed well (the model does not respond to changes in train capacity in the Low Alternative). The extension of Metrorail attracted riders, but primarily at the expense of competing bus and VRE service. Given the large investment required to realize a Metrorail extension, it was set aside for the current analysis. The High Alternative enhancements to VRE were similarly set aside due to cost considerations.

## Table 4-3. Refined Alternative

| Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|
| **Service Modifications** | | | |
| Arlington/Alexandria/D.C. | ART | **ART 41** -Add 5th bus to ART 41 on weekdays. | *Weekdays only – 6:30 a.m. to 8:30 p.m. Currently, every 15 minutes – increase to every 12 minutes.* |
| Arlington/Alexandria/D.C. | WMATA | **WMATA 7B –** Decrease headway on 7B from 35 minutes to 17/18 minutes by adding one bus. | *Weekdays only – 6:12 a.m. to 8:50 a.m. and 4:32 p.m. to 7:17 p.m.* |
| Prince William | PRTC | **Dale City-Navy Yard –** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds two additional trips per peak-period. | *Weekdays, peak-period only – involves 12 peak trips (6:00 a.m. and 6:00 p.m.). 4:38 a.m. to 8:27 a.m. and 3:37 p.m. to 8:00 p.m. Assume two additional trips per peak-period at 105 revenue minutes per trip.* |
| Prince William | PRTC | **OmniRide North Route 1 –** Increase frequency on OmniRide North Route 1 by adding additional trips in peak-period, one in midday, and late evening. | *Weekdays only – add three additional trips per peak-period, one in midday and one in late evening. Assume each trip takes 100 revenue minutes.* |
| Prince William | PRTC | **OmniLink Route 1 –** Extend OmniLink Route 1 to Ft. Belvoir during peak periods. | *Weekdays only – Extends route 7 miles – 4:00 a.m. runs and 4:00 p.m. runs would be extended. Assume 30 minutes additional revenue hours per run.* |
| Prince William | PRTC | **PW MetroDirect –** Modify Prince William MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours. | *Weekdays only – involves eight peak trips (4:00 a.m. and 4:00 p.m.). 5:25 a.m. to 8:15 a.m. and 4:35 p.m. to 7:30 p.m. Assume an additional 30 minutes for circulation.* |
| Corridor-wide | VRE | **VRE Train Size –** Increase train size so three of the Fredericksburg trains have eight cars and four have six cars. | *Assumes VRE's planned expansion to 36 daily trains is funded and that the existing VRE locomotive fleet will be funded and in place by 2015 and the new locomotives are capable of pulling eight car consists. Also assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. Would not need additional overnight storage at Crossroads Yard/Fredericksburg or improvements for D.C. or overnight storage under this scenario.* |

## Table 4-3. Refined Alternative (continued)

| Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|
| **New Shuttle/Feeder Bus Services** | | | |
| Alexandria | Alexandria | **Seminary Road Shuttle –** New shuttle from Seminary Road In-line stations to jobs at Mark Center and Skyline. | *Weekday peak only – 15-minute headways. Distance three miles/loop – 15 minutes per loop. Assume one vehicle.* |
| Fairfax/Springfield | Fairfax Connector | **Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttle –** New shuttle service between the Springfield Metro-EPG-Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway. | *Weekday peak only – 12-minute headways. Distance 15 miles/loop – 36 minutes per loop. Assume three vehicles. May need to adjust depending on access to base.* |
| Fairfax/Springfield | Fairfax Connector | **Lorton VRE-EPG-Ft. Belvoir Shuttle –** New "meet the train" shuttle or subscription service between the Lorton VRE Station-EPG/Ft. Belvoir via Telegraph Road, Fairfax County Parkway and Rolling Road/Pohick Road. | *Weekday peak only – timed to meet VRE/Amtrak trains to/from the south (6:00 a.m. and 6:00 p.m.). Distance seven to eight miles/loop – 15 minutes per loop. Assume two vehicles. May need to adjust depending on access to base.* |
| **New Bus/Rail Services** | | | |
| Arlington/Alexandria/D.C. | ART | **Shirlington-Rossyln –** New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area). | *Weekdays only – assumed 20-minute headways in peak only. Distance six miles – assume 20 minutes.* |
| Fairfax/Springfield | WMATA | **Kingstowne-Shirlington-Pentagon –** New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria. | *Weekdays only but all day – 30-minute headways offpeak and 20-minute headways in peak – bidirectional.* |
| Fairfax/Springfield | WMATA | **Lorton/Laurel Hill –EPG-Pentagon –** New express bus route from Lorton – EPG-Pentagon. Proposed at 15/30-minute headways in 2015 and 10/15 in 2030 – comment that the route should serve EPG southbound in the morning and northbound in the evening. | *Weekdays only – assumed 10-minute headways in peak only. Distance 15 miles – assume 45 minutes.* |
| Prince William/Fairfax | PRTC | **Woodbridge-Lorton-Tysons and Merrifield –** New OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons to Merrifield. | *Weekdays peak hour only – 30-minute headways.* |
| Prince William | PRTC | **Central PW-Downtown Alexandria –** New route from Central Prince William County and along I-95 corridor then serving East Eisenhower Valley and Downtown Alexandria west of Washington Street. | *Weekday 30-minute headways peak hour only. Distance 20 miles – assume 45 revenue minutes per trip.* |

## Table 4-3. Refined Alternative (continued)

| Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|
| **New Bus/Rail Services (continued)** | | | |
| Prince William | PRTC | **Central PW-Pentagon-D.C. –** New OmniRide Route to start near Hoadley Rd, run express down PW Parkway to the HOV lanes – Pentagon and D.C. | *Peak hours only – 45-minute headways.* |
| Prince William | PRTC | **Dale City/Lake Ridge-EPG –** New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30-minute headway). | *Weekday 30-minute headways peak hour only. Distance miles -15 miles – assume 30 revenue minutes per trip.* |
| Prince William | PRTC | **Dale City to Seminary Road Area-** New OmniRide Express Route from Dale City to Skyline, Bailey's Crossroads and Mark Center via Seminary Road. | *Weekdays only – peak-period – 45-minute headways serving Seminary Rd area – Mark Center, Skyline and other nearby employment centers – assume four trips in each peak-period.* |
| Prince William | PRTC | **Lake Ridge to Seminary Road Area –** New OmniRide Express Route from Lake Ridge to Skyline, Bailey's Crossroads and Mark Center via Seminary Road. | *Weekdays only – peak-period – 45-minute headways serving Seminary Rd area – Mark Center, Skyline and other nearby employment centers – assume four trips in each peak-period.* |
| Prince William | PRTC | **Woodbridge-EPG –** New OmniRide route from Woodbridge to EPG (proposed 30-minute headway peak only). | *Weekday 30-minute headways peak hour only. Distance 10 miles – assume 20 revenue minutes per trip.* |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg-D.C. –** New Express/BRT route from Fredericksburg to D.C. core (when combined with Massaponax, service would operate alternating 15 minutes). | *Weekday 30-minute headways peak hour only. Distance 55 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg-EPG/Ft. Belvoir –** New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir. | *Weekday 30-minute headways peak hour only. Distance 40 miles – assume 1.5 revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg-Pentagon/Crystal City –** New Express/ BRT route from Fredericksburg to Pentagon/Crystal City. | *Weekday 30-minute headways peak hour only. Distance 50 miles – assumed two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg-Tysons Corner-Merrifield** – Extension of the new Woodbridge-Lorton-Tysons-Merrifield route-OmniRide express route from East PW to new Lorton VRE easy on/off to Tysons to Merrifield. | *Weekday 30-minute headways peak hour only – included as an extension of the Prince William-Tysons-Merrifield route. Distance 55 miles – 12 trips (6:00 a.m. and 6:00 p.m.). Could be run with transfer at Lorton rather than non-express through Woodbridge.* |
| Stafford/ Fredericksburg | FAMPO | **Massaponax to D.C.** – New Express/BRT route from Massaponax to D.C. core (when combined with Fredericksburg-D.C. route, service would operate alternating 15 minutes). | *Weekday 30-minute headways peak hour only. Distance 60 miles – assume two revenue hours per trip – 12 trips (6:00 a.m. and 6:00 p.m.).* |
| Corridor-wide | VRE/Amtrak | Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of six and eight car trains. | *Assumes agreement with Amtrak to expand midday storage at Ivy City and L'Enfant storage tracks. May need additional overnight storage at Crossroads Yard/Fredericksburg but would not need additional midday storage at D.C. under this consist mix scenario.* |

## Table 4-3. Refined Alternative (continued)

| Originating Area | Operator | Description | Service Frequency/Span Assumptions |
|---|---|---|---|
| **Fixed Facilities** | | | |
| Arlington/Alexandria/D.C. | WMATA | Improvements at **Pentagon Metrorail Transit Center** (additional bus bays, real-time information, traffic circulation/access/egress, security improvements). | |
| Fairfax/Springfield | Fairfax | Improvements at **Franconia-Springfield Metrorail Transit Center** (additional bus bays and bus canopies, real-time information, traffic circulation/access/egress, security improvements). | |
| Fairfax/Springfield | Fairfax | **Transit Cente**r near Ft. Belvoir/EPG. | |
| Fredericksburg | FAMPO | **Transit Center** at Massaponax. | |
| Fredericksburg | FAMPO | **Transit Center** at Route 610. | |
| Corridor-wide | | **Additional park-and-ride lot capacity** at various locations (new and/or existing lots). | |
| Corridor-wide | | **In line transit station**s considered along the corridor – four in-line stations included in cost. | *Suggested locations: Seminary Road vicinity, Lorton (included in HOT project cost rather than here), Prince William Parkway, VA Route 610, U.S. 17/Warrenton.* |
| Corridor-wide | | **ITS projects** to improve integration of information on HOT lanes/parking lots/bus/rail – NEXT Bus. | |
| Corridor-wide | VRE | **Overnight Storage in Fredericksburg.** | *With the increase in trains to 20, VRE will need additional storage at Crossroads in Fredericksburg.* |
| Corridor-wide | VRE | **Platform Extensions** at selected stations. | *In order for VRE to run eight-car trains, platforms at key stations should be extended – VRE estimate four stations needing platform improvements. Can have eight-car trains at short platforms but not optimum.* |

## Table 4-3. Refined Alternative (continued)

| Originating Area | Program | Description |
|---|---|---|
| **TDM Program Elements** | | |
| Corridor-wide | **Capital Assistance For Vanpools** | *Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of capital cost of contracting for vanpools. Provide free electronic toll transponders to vanpools.* |
| Corridor-wide | **Carpool Incentives** | *Rewards and incentives for carpoolers.* |
| Corridor-wide | **Electronic Toll Transponders for Vanpools** | *Provide free electronic toll transponders to vanpools. (Although vanpools will use the toll lanes for free, this program is included in case some type of verification is needed to determine that the vehicle is a vanpool)* |
| Corridor-wide | **Enhanced Guaranteed Ride Home** | *Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday.* |
| Corridor-wide | **HOVER Pilot Program** | *HOVER is a facilitated "park and ride-share" system that involves tracking of all participants' usage, and sharing of costs and benefits through a combination of financial and "HOVER Ride Credit" accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150 – 200 spaces is needed.* |
| Corridor-wide | **Rideshare Program Operational Support** | *Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit.* |
| Corridor-wide | **TDM Programs Marketing** | *Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs.* |

## Table 4-3. Refined Alternative (continued)

| Originating Area | Description | Service Frequency/Span Assumptions |
|---|---|---|
| ***TDM Program Elements (continued)*** | | |
| Corridor-wide | **Telework Program Assistance** | *Financial incentives for employers that start new telework programs at their worksites, funding for home-based equipment costs and consulting support.* |
| Corridor-wide | **Vanpool Driver Incentives** | *Provide incentives to get new drivers and retain existing drivers for vanpools.* |
| Corridor-wide | **Vanpool Insurance** | *Increase vanpool insurance premium pool buy-down for vanpools.* |
| Corridor-wide | **VanStart/VanSave** | *Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats.* |

# 5.0 Travel Demand Forecasts

This section presents the results of the travel demand forecast for the I-95/I-395 Transit/TDM Study as well as a brief overview of the methodology. The travel demand forecasting effort for this analysis focuses on two design years and four scenarios comprised of a baseline scenario and three build alternatives. In addition, a final refined alternative and two other sensitivity alternatives were tested. As described in Section 2.0, the baseline scenario represents the existing network, the proposed HOT facilities, and other planned facilities, services, and programs identified in the CLRP or by the TAC. The alternatives were evaluated for years 2015 and 2030.

The travel demand forecast estimated demand for usage of motorized modes, including low-occupancy vehicles with one or two occupants (LOV), high-occupancy vehicles with three or more occupants (HOV), commuter rail passengers, heavy rail passengers, bus passengers, and bus to rail passengers. The forecasts were used to analyze and refine a set of comprehensive transit and TDM measures.

The travel demand forecast model being applied for this project was the adopted and approved MWCOG regional travel demand forecast model set Version 2.1D#50. It covers the entire metropolitan region and at the time of this study it was the current model set adopted for conformity analysis.

As a post-process to the Version 2.1D#50 model, the study applied two additional exclusive steps. The first step was the application of a post-process nested-logit mode choice model. This is a model developed for the Washington Metropolitan Area Transit Authority (WMATA) for application to the MWCOG model results. It is being used similarly on other studies in the region and is slated to be incorporated into the next version of the MWCOG travel demand forecast model, Version 2.3. The chief benefit of the post-process mode choice model is that it more precisely examines submode choices, including access choice and specific transit mode choices.

The second post-process used was a subzone highway assignment. This was done to improve the accuracy of the highway forecast for zones in the southern boundary area of the MWCOG model network. The model network has less detail at the boundaries. We applied the Fredericksburg Area Metropolitan Planning Organization (FAMPO) zone structure in the southern boundary area to improve the accuracy of the highway assignment and obtain more accurate highway congested travel impedances.

In addition to these two post-processors, the study had two additional post-processors that ran as supplements: 1) a park-and-ride lot demand forecasting tool; and 2) a TDM analysis framework. These tools utilized outputs from the regional forecasting tool as inputs, and were applied with feedback to the regional forecasting tool for purposes of interpreting results.

## *5.1 Regional Forecasting Tool Details*

The MWCOG travel demand forecast model uses a series of submodels or steps to forecast potential travel demand given the future land use and transportation networks. The regional transportation options are represented in terms of a network. The network represents all of the transportation services and infrastructure. This network includes transit and highway facilities. The Washington metropolitan area is divided into 2,191 traffic analysis zones (TAZ). In the more densely populated areas there are a greater number of TAZs and in less dense areas the TAZs are larger. At the boundaries of the modeled areas the TAZs are larger and the highway network is less detailed. In the primary modeled jurisdictions, the highway network is more detailed and the corresponding number of TAZs is greater.

## *5.2 Results of Baseline and Tiered Transit/TDM Alternative Analysis*

The project and service elements of each of the tiered transit/TDM alternatives were represented in the inputs for the travel demand forecasting tools. The models were applied for horizon years 2015 and 2030. The following section provides an overview of these forecasts.

Table 5-1 presents the aggregate demand, high-level mode choice for each alternative (High, Medium, and Low) for 2015 and 2030. The results show an increase in total work trips in the study corridor of 24 percent from year 2000 to year 2015 and 42 percent from year 2000 to year 2030. Regionally there is a 26 percent increase for year 2015 and a 44 percent increase for year 2030, which corresponds to the corridor results.

Overall, for work trips in the corridor, the mode shares remain approximately unchanged with HOV around 6 percent, transit around 33 percent, and LOV around 60 percent. The land use patterns and highway network in the area have encouraged the current patterns and these patterns are forecast to continue given the proposed future land use and infrastructure in the corridor. Specifically, many new jobs are expected to locate in areas that are outside of the current core and that are currently outside existing transit service markets.

For usage of specific modes in the study corridor, there is an increase of approximately 19 percent for HOV, 15 percent for transit, and 30 percent for LOV from year 2000 to year 2015. For year 2030 the approximate increase in HOV from the base year is the same as in year 2015. Even though the number of HOV trips is fairly constant between years 2015 and 2030, the markets and travel sheds change from 2015 to 2030. There is a 30 percent increase in transit trips from year 2000 to year 2030 for the corridor and a 53 percent increase in LOV home-based work trips from year 2000 to year 2030. The introduction of additional direct-to-destination bus services is partially responsible for the dampening of Metrorail ridership in several 2030 scenarios. The large investment in the High Alternative results in only a small increase in transit mode share as compared to the other investment levels.

## Table 5-1. Mode Choice Model Results (Post-Processor) for Tiered Alternatives

*Home-Based Work Trips*

| Mode | 2000 | 2015 BSL | 2015 LO | 2015 MED | 2015 HI | 2030 BSL | 2030 LO | 2030 MED | 2030 HI |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | | | | | | | | | |
| LOV | 520,791 | 678,819 | 677,677 | 675,319 | 673,042 | 795,818 | 794,583 | 789,992 | 791,018 |
| TRN | 317,851 | 365,902 | 367,134 | 368,285 | 370,338 | 412,418 | 414,002 | 414,822 | 418,378 |
| HOV | 61,668 | 73,437 | 72,949 | 72,573 | 71,725 | 73,003 | 72,881 | 72,680 | 71,837 |
| **Total** | **900,310** | **1,118,158** | **1,117,760** | **1,116,177** | **1,115,105** | **1,281,239** | **1,281,466** | **1,277,494** | **1,281,233** |
| LOV | 57.8% | 60.7% | 60.6% | 60.5% | 60.4% | 62.1% | 62.0% | 61.8% | 61.7% |
| TRN | 35.3% | 32.7% | 32.8% | 33.0% | 33.2% | 32.2% | 32.3% | 32.5% | 32.7% |
| HOV | 6.8% | 6.6% | 6.5% | 6.5% | 6.4% | 5.7% | 5.7% | 5.7% | 5.6% |
| **Study Area to Core** | | | | | | | | | |
| LOV | 100,442 | 115,674 | 115,216 | 114,594 | 113,372 | 116,553 | 116,187 | 115,660 | 114,850 |
| TRN | 225,176 | 248,867 | 249,492 | 249,968 | 251,220 | 274,330 | 275,201 | 275,246 | 277,377 |
| HOV | 33,597 | 40,299 | 39,863 | 39,558 | 38,758 | 36,394 | 36,284 | 36,062 | 35,301 |
| **Total** | **359,215** | **404,840** | **404,571** | **404,120** | **403,350** | **427,277** | **427,672** | **426,968** | **427,528** |
| LOV | 28.0% | 28.6% | 28.5% | 28.4% | 28.1% | 27.3% | 27.2% | 27.1% | 26.9% |
| TRN | 62.7% | 61.5% | 61.7% | 61.9% | 62.3% | 64.2% | 64.3% | 64.5% | 64.9% |
| HOV | 9.4% | 10.0% | 9.9% | 9.8% | 9.6% | 8.5% | 8.5% | 8.4% | 8.3% |

**Modes**
**LOV** Low-occupancy vehicle (less than three occupants)
**TRN** Transit
**HOV** High-occupancy vehicle (three or more occupants)

Table 5-2 shows the output from the WMATA Post-Processor model for the submodes. These are home-based work trips. The submodes are motor bus (MB), Metrorail or heavy rail (HR), commuter rail (CR), and motor bus to Metrorail (MB-HR).

The submode choice results by alternative show that where transit service was increased the mode usage increased. In the High Alternative, Metrorail was extended to serve Lorton and Potomac Mills. This new service competed with the commuter rail service and, in this alternative, Metrorail mode share increased while commuter rail mode share decreased. That is, extending Metrorail to Potomac Mills appears to redistribute transit users among different modes rather than increasing transit usage. It can also be noted that bus has a large share of the trips in the corridor, but it also represents the bulk of the transit service provided in the corridor. Commuter rail has the lowest mode share but also the least amount of service provided.

## Table 5-2. Mode Choice Model Results (Post-Processor) for Tiered Alternatives

*Home-Based Work Trips Submode Level*

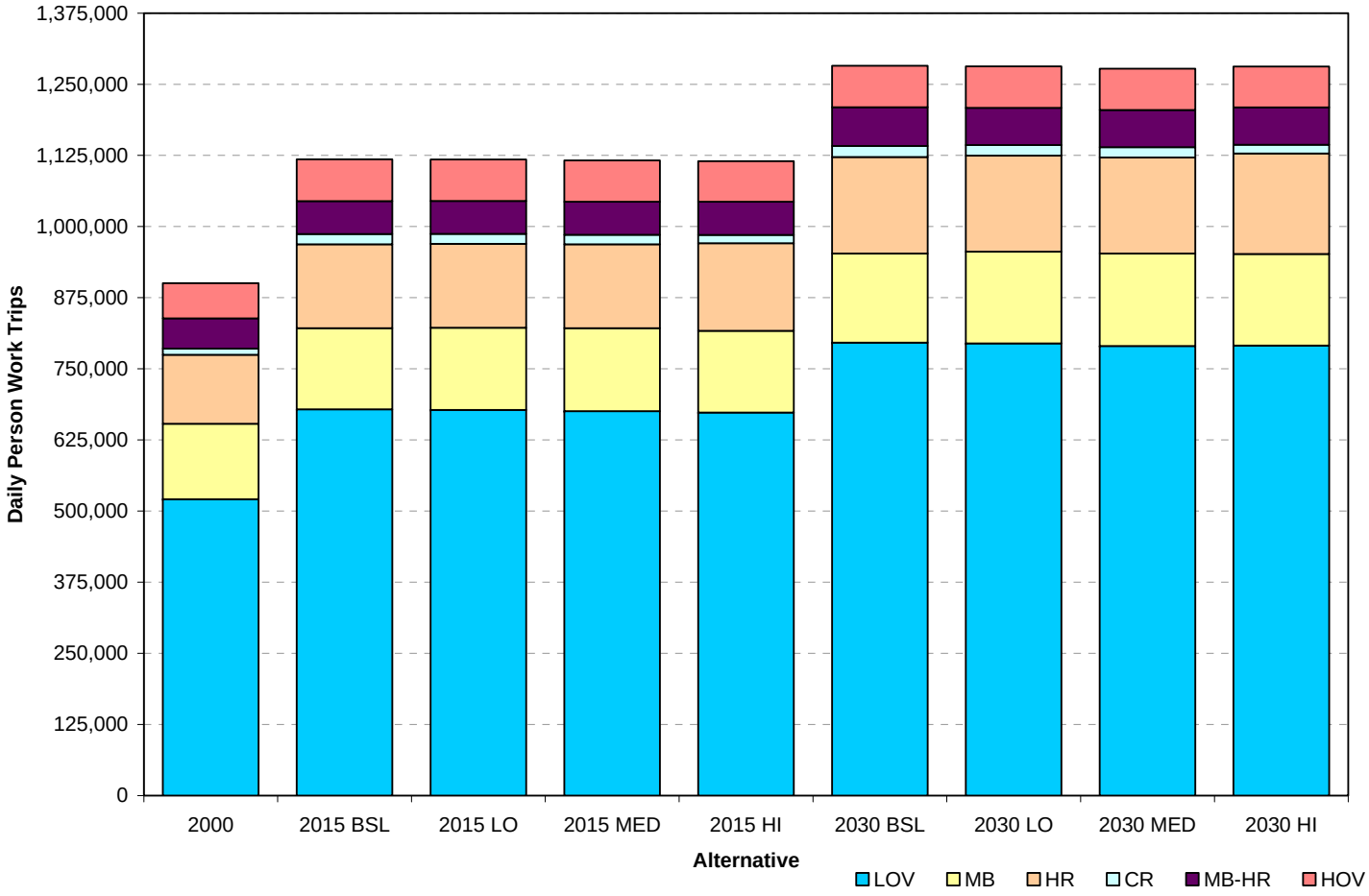
| Mode | 2000 | 2015 BSL | 2015 LO | 2015 MED | 2015 HI | 2030 BSL | 2030 LO | 2030 MED | 2030 HI |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | | | | | | | | | |
| MB | 132,595 | 142,409 | 144,551 | 146,002 | 143,766 | 156,921 | 161,309 | 162,649 | 160,784 |
| HR | 121,407 | 147,525 | 147,469 | 147,327 | 153,988 | 169,374 | 168,640 | 168,672 | 176,414 |
| CR | 10,561 | 18,009 | 17,365 | 16,985 | 14,660 | 19,360 | 18,678 | 18,069 | 15,559 |
| MB-HR | 53,264 | 57,958 | 57,734 | 57,946 | 57,899 | 68,162 | 65,352 | 65,406 | 65,590 |
| MB | 42% | 39% | 39% | 40% | 39% | 38% | 39% | 39% | 38% |
| HR | 38% | 40% | 40% | 40% | 42% | 41% | 41% | 41% | 42% |
| CR | 3% | 5% | 5% | 5% | 4% | 5% | 5% | 4% | 4% |
| MB-HR | 17% | 16% | 16% | 16% | 16% | 16% | 16% | 16% | 16% |
| **Study Area to Core** | | | | | | | | | |
| MB | 75,964 | 76,389 | 77,715 | 78,170 | 76,334 | 81,438 | 83,974 | 84,038 | 82,449 |
| HR | 102,194 | 118,507 | 118,433 | 118,420 | 123,628 | 133,616 | 133,150 | 133,281 | 139,109 |
| CR | 8,299 | 14,198 | 13,707 | 13,431 | 11,432 | 14,732 | 14,244 | 13,842 | 11,718 |
| MB-HR | 38,715 | 39,776 | 39,636 | 39,940 | 39,825 | 45,350 | 43,834 | 44,079 | 44,099 |
| MB | 34% | 31% | 31% | 31% | 30% | 30% | 31% | 31% | 30% |
| HR | 45% | 48% | 47% | 47% | 49% | 49% | 48% | 48% | 50% |
| CR | 4% | 6% | 5% | 5% | 5% | 5% | 5% | 5% | 4% |
| MB-HR | 17% | 16% | 16% | 16% | 16% | 16% | 16% | 16% | 16% |

**Transit Mode**

**MB** Motor Bus
**HR** Heavy Rail (Metrorail)
**CR** Commuter Rail (VRE)
**MB-HR** Motor Bus to Heavy Rail

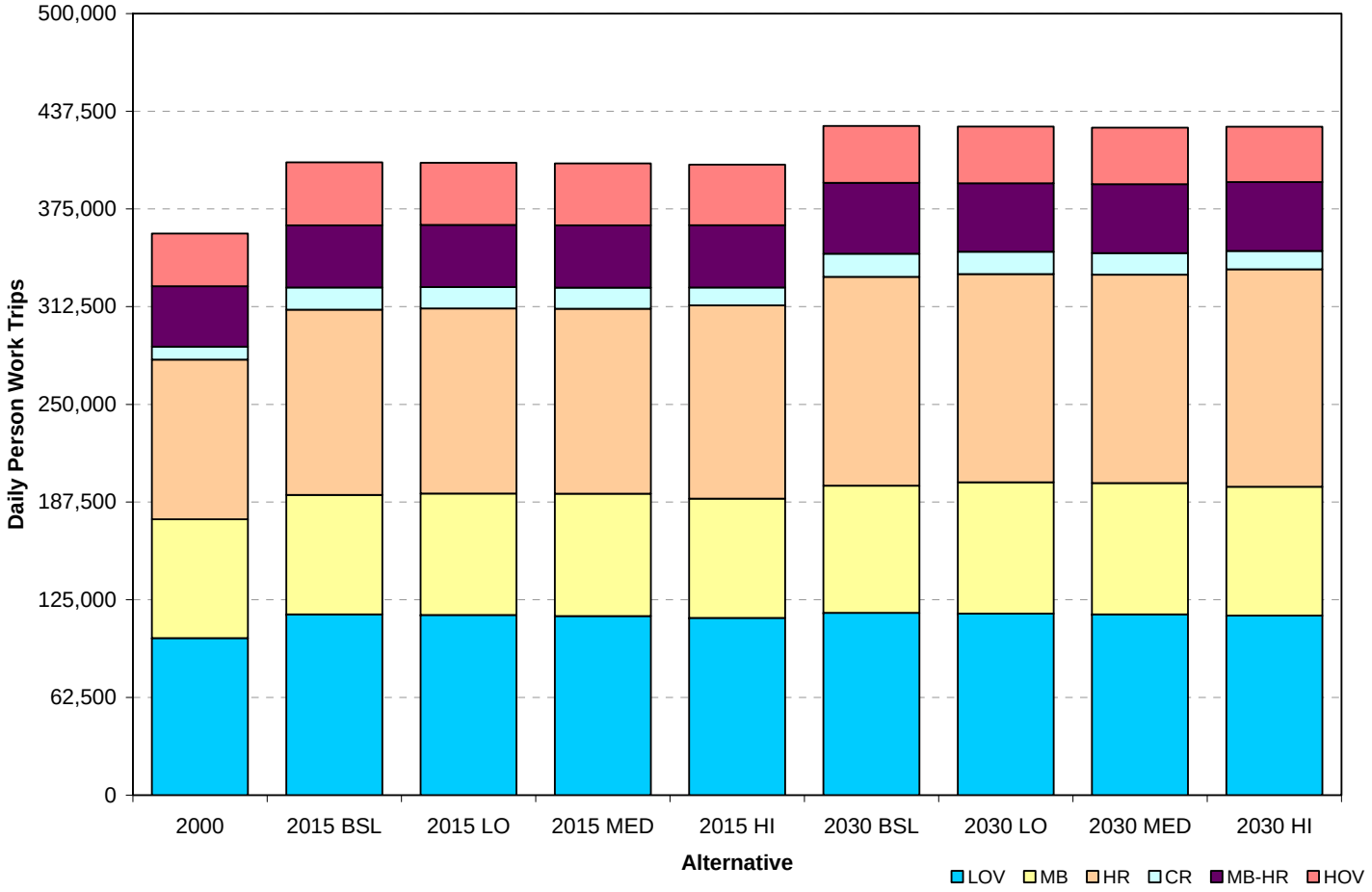
Figures 5-1 through 5-2 graphically represent the data included in the tables. These charts highlight the results and show that there are small percentage changes in primary mode choice among the alternatives on a study area and study-area-to-the-core basis. These small changes in mode choice are due to the fact that the corridor has very robust transit service and high HOV patronage under the existing conditions. Most of the differences in performance among the proposed alternatives are in submode choice (i.e., shifts among bus (MB), Metrorail (HR), and commuter rail (CR)).

## Figure 5-1. Corridor Mode Share – Tiered Alternatives




**LOV –** Low-occupancy vehicle
**MB –** Motor bus
**HR –** Metrorail or heavy rail
**CR –** Commuter rail
**MB-HR –** Motor bus to Metrorail
**HOV –** High-occupancy vehicle
**BSL –** Baseline
**LO –** Low
**MED –** Medium
**HI –** High

**Figure 5-2. Corridor Mode Share to Core – Tiered Alternatives**




**LOV –** Low-occupancy vehicle
**MB –** Motor bus
**HR –** Metrorail or heavy rail
**CR –** Commuter rail
**MB-HR –** Motor bus to Metrorail
**HOV –** High-occupancy vehicle
**BSL –** Baseline
**LO –** Low
**MED –** Medium
**HI –** High

Table 5-3 gives the assignment summary for home-based work trips in the AM peak period in the northbound direction only based on the gross model results at two locations: Crossing the Beltway (I-495) and Crossing Glebe Road. These screenlines provide a snapshot of the transit ridership in the corridor. Outside the Beltway HOV carries the bulk of the person work trips northbound, while inside the Beltway the person trips are more equally distributed among transit modes and HOV. This could be a function of the quality of service and the increase of bus service inside the Beltway. Commuter rail carries the smallest number of people but also has less service than other modes.

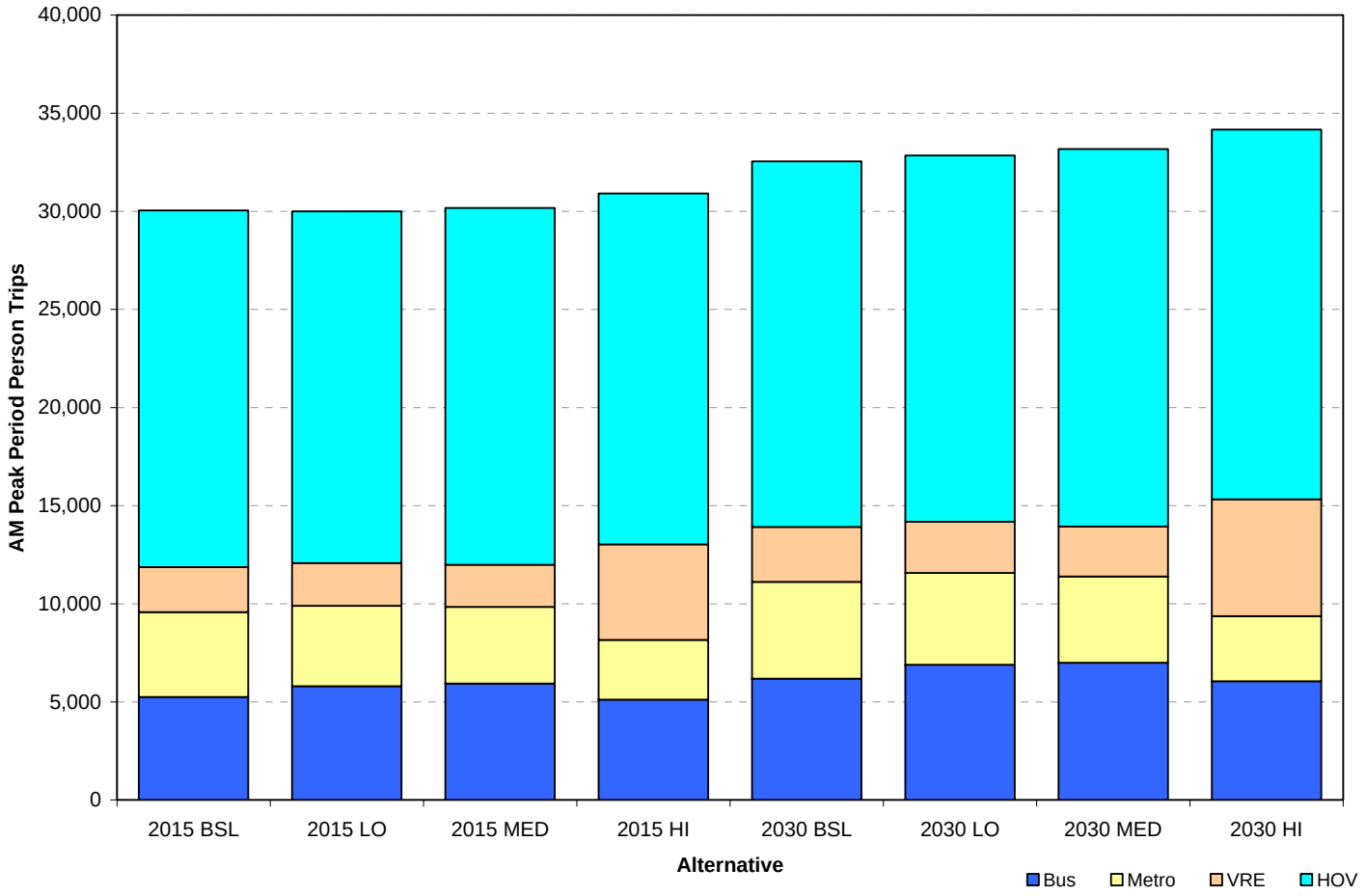
Figures 5-3 and 5-4 provide a graphical illustration of the differences in transit usage among alternatives at the same screenlines. The table and figures help illustrate, for example, that in the High Alternative (which includes an extension of Metrorail to Potomac Mills Mall) Metrorail ridership comes, in part, from competing bus transit and commuter rail transit modes.

## Table 5-3. Assignment Summary for Tiered Alternatives

*Home-Based Work AM Peak Period Northbound Trips (Gross Model Results)*

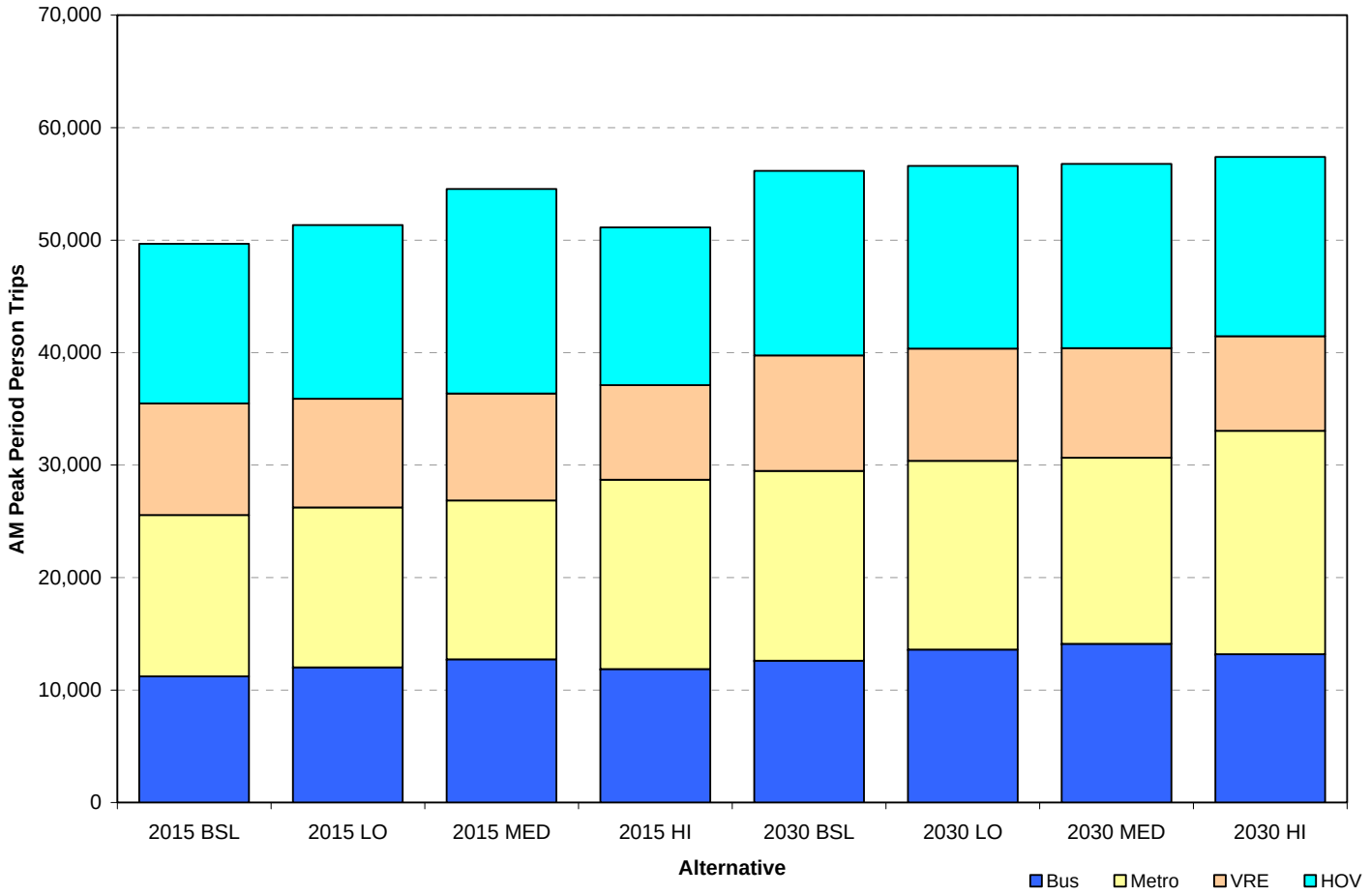
| Mode | 2015 BSL | 2015 LO | 2015 MED | 2015 HI | 2030 BSL | 2030 LO | 2030 MED | 2030 HI |
|---|---|---|---|---|---|---|---|---|
| **Crossing Beltway** | | | | | | | | |
| Bus | 5,250 | 5,798 | 5,936 | 5,114 | 6,182 | 6,892 | 6,995 | 6,049 |
| Metro | 4,329 | 4,095 | 3,906 | 3,043 | 4,939 | 4,683 | 4,397 | 3,322 |
| VRE | 2,289 | 2,179 | 2,151 | 4,868 | 2,800 | 2,608 | 2,552 | 5,951 |
| HOV | 18,177 | 17,931 | 18,177 | 17,889 | 18,624 | 18,663 | 19,230 | 18,846 |
| **Total** | **30,045** | **30,003** | **30,170** | **30,914** | **32,545** | **32,846** | **33,174** | **34,168** |
| Bus | 17.5% | 19.3% | 19.7% | 16.5% | 19.0% | 21.0% | 21.1% | 17.7% |
| Metro | 14.4% | 13.6% | 12.9% | 9.8% | 15.2% | 14.3% | 13.3% | 9.7% |
| VRE | 7.6% | 7.3% | 7.1% | 15.7% | 8.6% | 7.9% | 7.7% | 17.4% |
| HOV | 60.5% | 59.8% | 60.2% | 57.9% | 57.2% | 56.8% | 58.0% | 55.2% |
| **Crossing Glebe Road** | | | | | | | | |
| Bus | 11,224 | 12,007 | 12,726 | 11,870 | 12,612 | 13,612 | 14,109 | 13,194 |
| Metro | 14,337 | 14,228 | 14,128 | 16,836 | 16,881 | 16,762 | 16,557 | 19,865 |
| VRE | 9,931 | 9,666 | 9,514 | 8,403 | 10,258 | 9,990 | 9,730 | 8,405 |
| HOV | 14,190 | 15,444 | 18,177 | 14,025 | 16,413 | 16,239 | 16,383 | 15,927 |
| **Total** | **49,682** | **51,345** | **54,545** | **51,134** | **56,164** | **56,603** | **56,779** | **57,391** |
| Bus | 22.6% | 23.4% | 23.3% | 23.2% | 22.5% | 24.0% | 24.8% | 23.0% |
| Metro | 28.9% | 27.7% | 25.9% | 32.9% | 30.1% | 29.6% | 29.2% | 34.6% |
| VRE | 20.0% | 18.8% | 17.4% | 16.4% | 18.3% | 17.6% | 17.1% | 14.6% |
| HOV | 28.6% | 30.1% | 33.3% | 27.4% | 29.2% | 28.7% | 28.9% | 27.8% |

## Figure 5-3. Northbound Trips on I-95 at Beltway – Tiered Alternatives




**BSL –** Baseline
**LO –** Low
**HI –** High
**VRE –** Virginia Railway Express
**MED –** Medium
**HOV –** High-occupancy vehicle

**Figure 5-4. Northbound Trips on I-395 at Glebe Road – Tiered Alternatives**




**BSL –** Baseline
**LO –** Low
**HI –** High
**VRE –** Virginia Railway Express
**MED –** Medium
**HOV –** High-occupancy vehicle

## *5.3 Refined Alternative Scenario*

The Refined Alternative reflects the best services from all of the alternative testing. It was developed from the tiered transit/TDM alternatives based on the model results and discussions with the TAC. The Refined Alternative was tested for both a 2015 and a 2030 horizon year.

The Refined Alternative produced results similar to the Medium-Level Alternative. Compared to the Baseline Alternative the transit mode share increases slightly. Results of the 2015 and 2030 Refined Alternative scenario are shown in Tables 5-4 and 5-5 and Figures 5-5 through 5-8.

As Table 5-4 shows, the forecast for the Refined Alternative has a slight decrease in LOV trips while the HOV share stays constant. The Refined Alternative shows a lowering of LOV mode share. This is a result of the good performance of the collection of transit service improvements included in it. The shifts in share are small, though, due to the forecast changes in land use in the study area, including new job opportunities outside of the core, as well as the proposed highway network improvements. The mode share for trips to the metropolitan core is very healthy compared to other areas in the region and nationally.

**Table 5-4. Mode Choice Model Results (Post-Processor) for Refined Alternatives**
*Home-Based Work Trips*

| Mode | 2000 | 2015 BSL | 2015 Refined | 2030 BSL | 2030 Refined |
|---|---|---|---|---|---|
| **Study Area** | | | | | |
| LOV | 520,791 | 678,819 | 675,268 | 795,818 | 790,722 |
| TRN | 317,851 | 365,902 | 367,384 | 412,418 | 415,795 |
| HOV | 61,668 | 73,437 | 72,351 | 73,003 | 72,828 |
| **Total** | **900,310** | **1,118,158** | **1,115,003** | **1,281,239** | **1,279,345** |
| LOV | 57.8% | 60.7% | 60.6% | 62.1% | 61.8% |
| TRN | 35.3% | 32.7% | 32.9% | 32.2% | 32.5% |
| HOV | 6.8% | 6.6% | 6.5% | 5.7% | 5.7% |
| **Study Area to Core** | | | | | |
| LOV | 100,442 | 115,674 | 114,977 | 116,553 | 115,951 |
| TRN | 225,176 | 248,867 | 248,952 | 274,330 | 275,598 |
| HOV | 33,597 | 40,299 | 39,478 | 36,394 | 36,273 |
| **Total** | **359,215** | **404,840** | **403,407** | **427,277** | **427,822** |
| LOV | 28.0% | 28.6% | 28.5% | 27.3% | 27.1% |
| TRN | 62.7% | 61.5% | 61.7% | 64.2% | 64.4% |
| HOV | 9.4% | 10.0% | 9.8% | 8.5% | 8.5% |

**Modes**
**LOV** Low-occupancy vehicle (less than three occupants)
**TRN** Transit
**HOV** High-occupancy vehicle (three or more occupants)

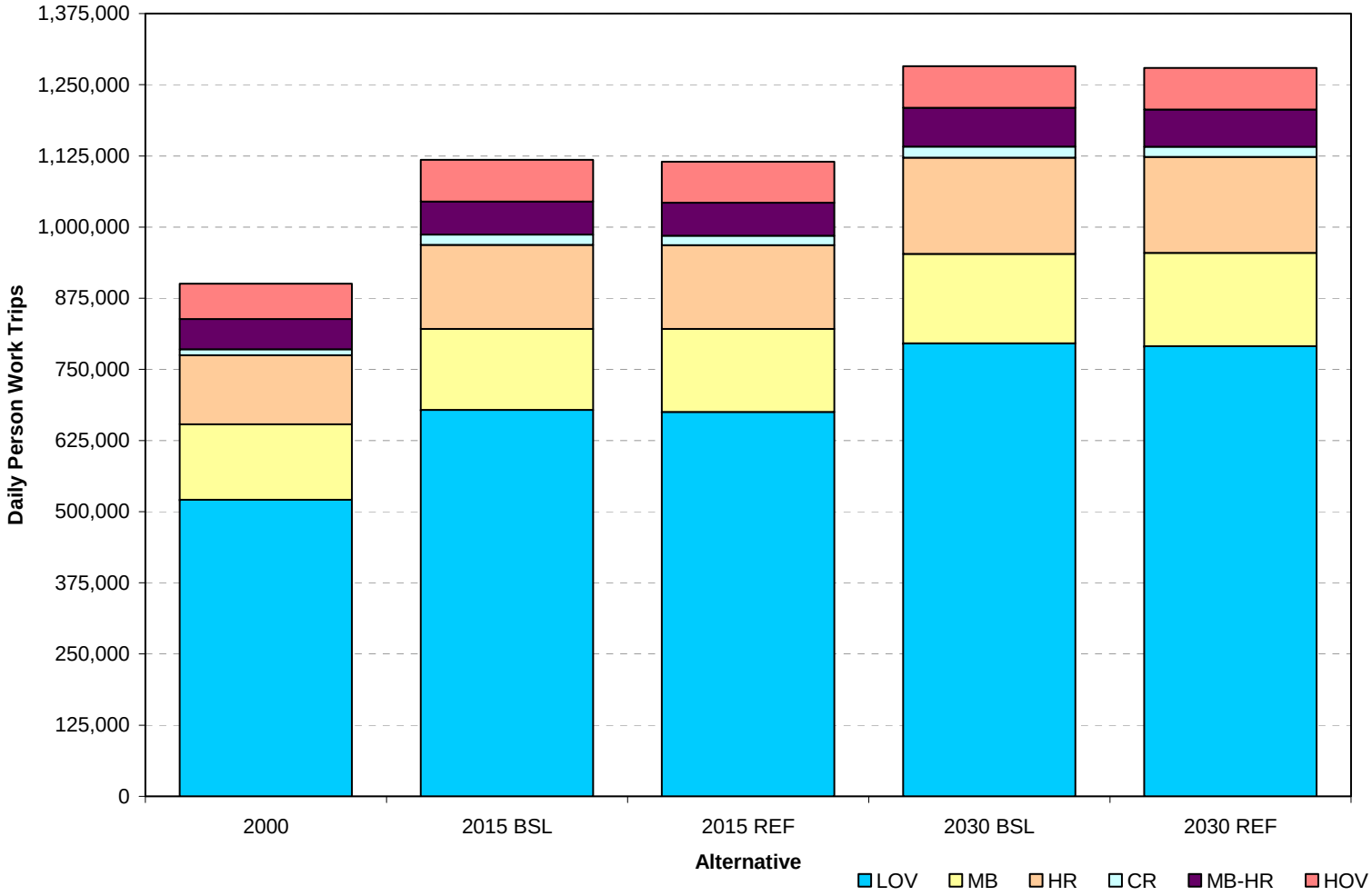
The submode forecasts, shown at the two screenlines (i.e., crossing the Beltway and crossing Glebe Road), show an increase in mode share for bus in the Refined Alternative versus in the Baseline Alternative due to the associated increase in bus service. The mode share within the transit submodes reflects a more equal distribution within the Beltway than outside the Beltway.

## Table 5-5. Assignment Summary for Refined Alternatives

*Home-Based Work AM Peak Period Northbound Trips*
*(Gross Model Results)*

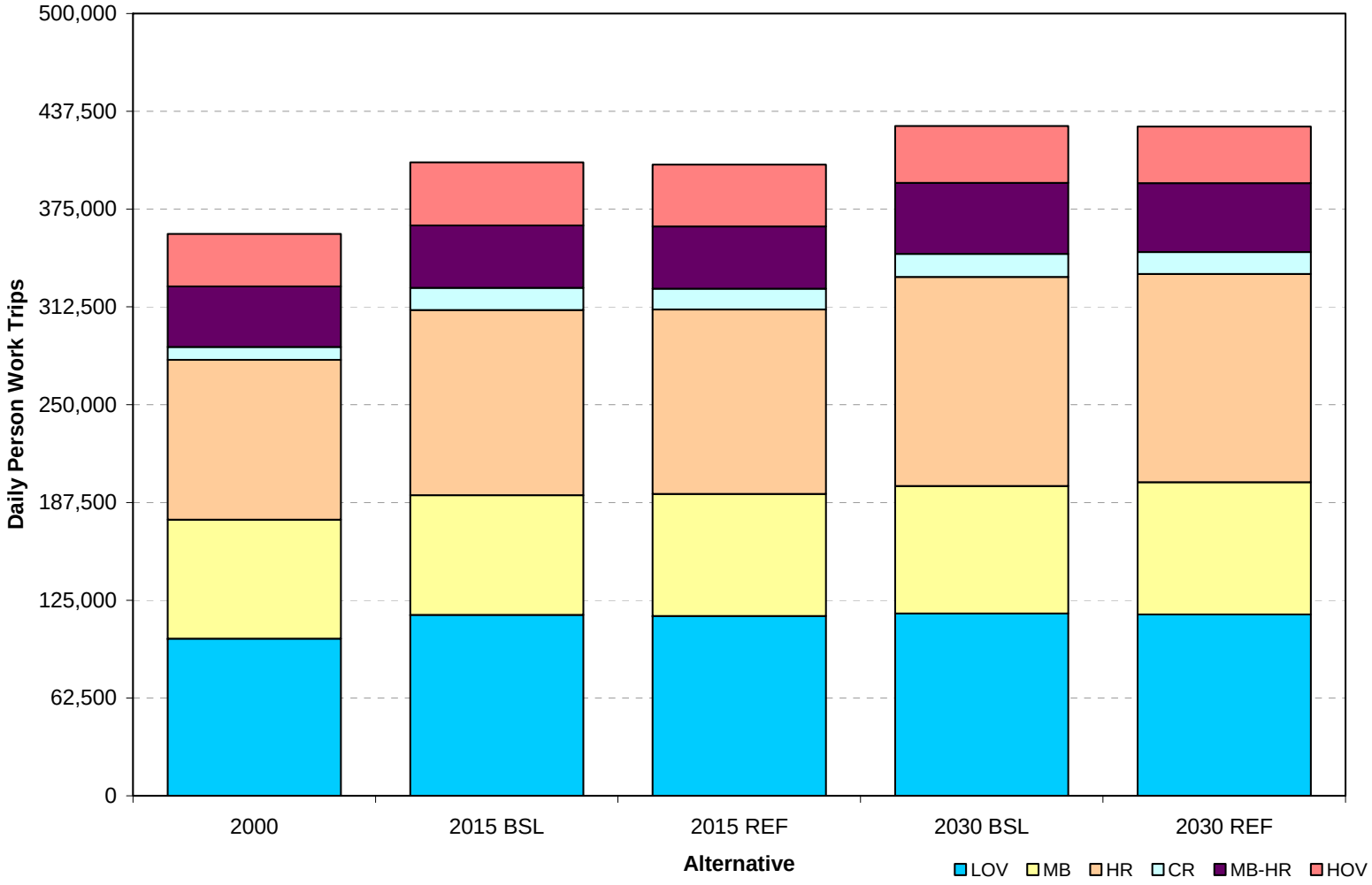
| | Crossing Beltway | | | |
|---|---|---|---|---|
| **Mode** | **2015 BSL** | **2015 REF** | **2030 BSL** | **2030 REF** |
| Bus | 5,250 | 6,023 | 6,182 | 7,204 |
| Metro | 4,329 | 3,875 | 4,939 | 4,428 |
| VRE | 2,289 | 2,114 | 2,800 | 2,504 |
| HOV | 18,177 | 16,503 | 18,624 | 19,164 |
| **Total** | **30,045** | **28,515** | **32,545** | **33,300** |
| Bus | 17.5% | 21.1% | 19.0% | 21.6% |
| Metro | 14.4% | 13.6% | 15.2% | 13.3% |
| VRE | 7.6% | 7.4% | 8.6% | 7.5% |
| HOV | 60.5% | 57.9% | 57.2% | 57.5% |
| | **Crossing Glebe Road** | | | |
| Bus | 11,224 | 12,746 | 12,612 | 12,426 |
| Metro | 14,337 | 14,021 | 16,881 | 13,724 |
| VRE | 9,931 | 9,415 | 10,258 | 9,073 |
| HOV | 14,190 | 12,201 | 16,413 | 15,615 |
| **Total** | **49,682** | **48,383** | **56,164** | **50,838** |
| Bus | 22.6% | 26.3% | 22.5% | 24.4% |
| Metro | 28.9% | 29.0% | 30.1% | 27.0% |
| VRE | 20.0% | 19.5% | 18.3% | 17.8% |
| HOV | 28.6% | 25.2% | 29.2% | 30.7% |

**Figure 5-5. Corridor Submode Share – Refined Alternative**



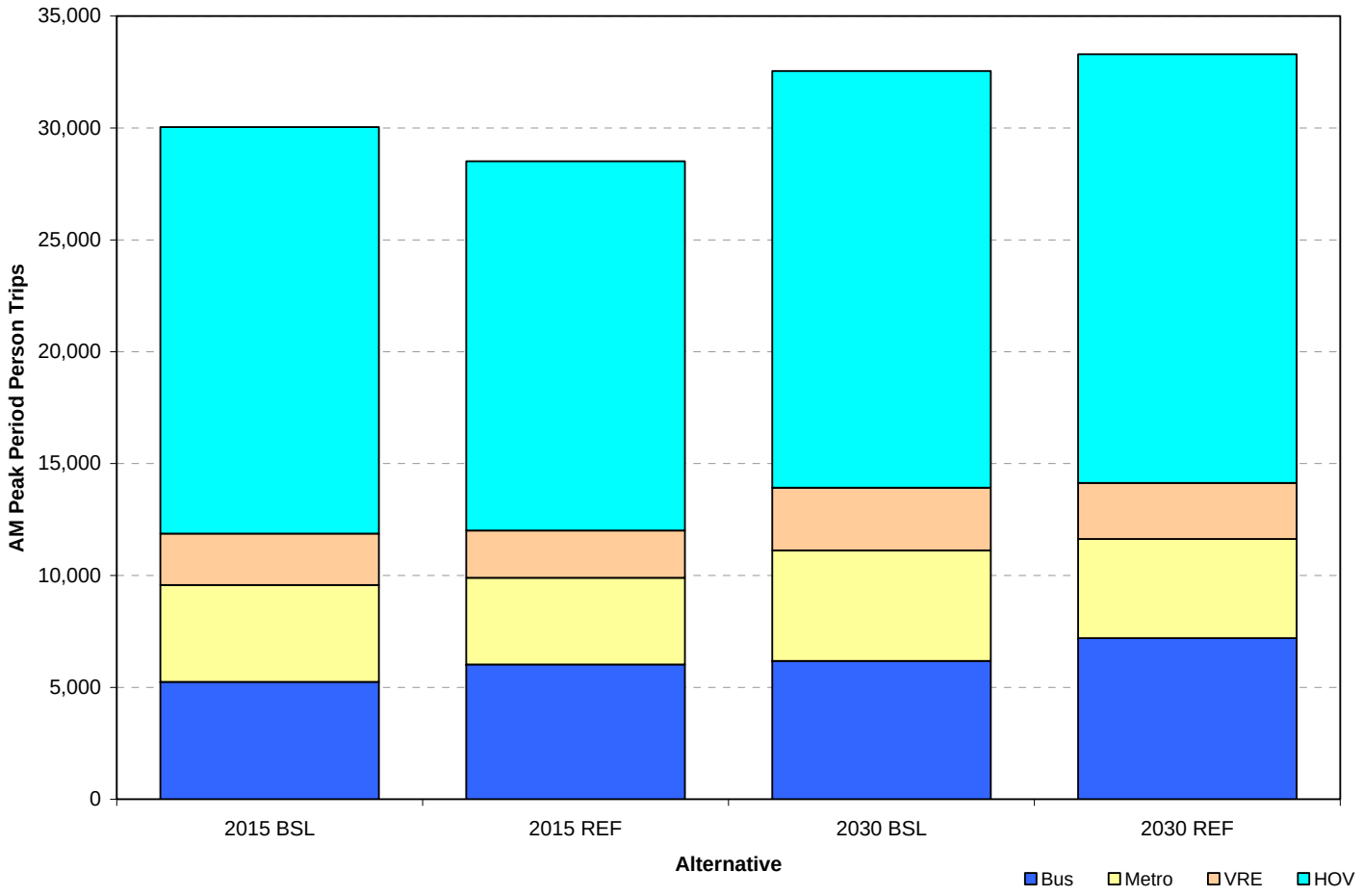

**LOV –** Low-occupancy vehicle **HR –** Metrorail heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
**MB –** Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined Alternative

**Figure 5-6. Corridor Submode Share to Core – Refined Alternative**



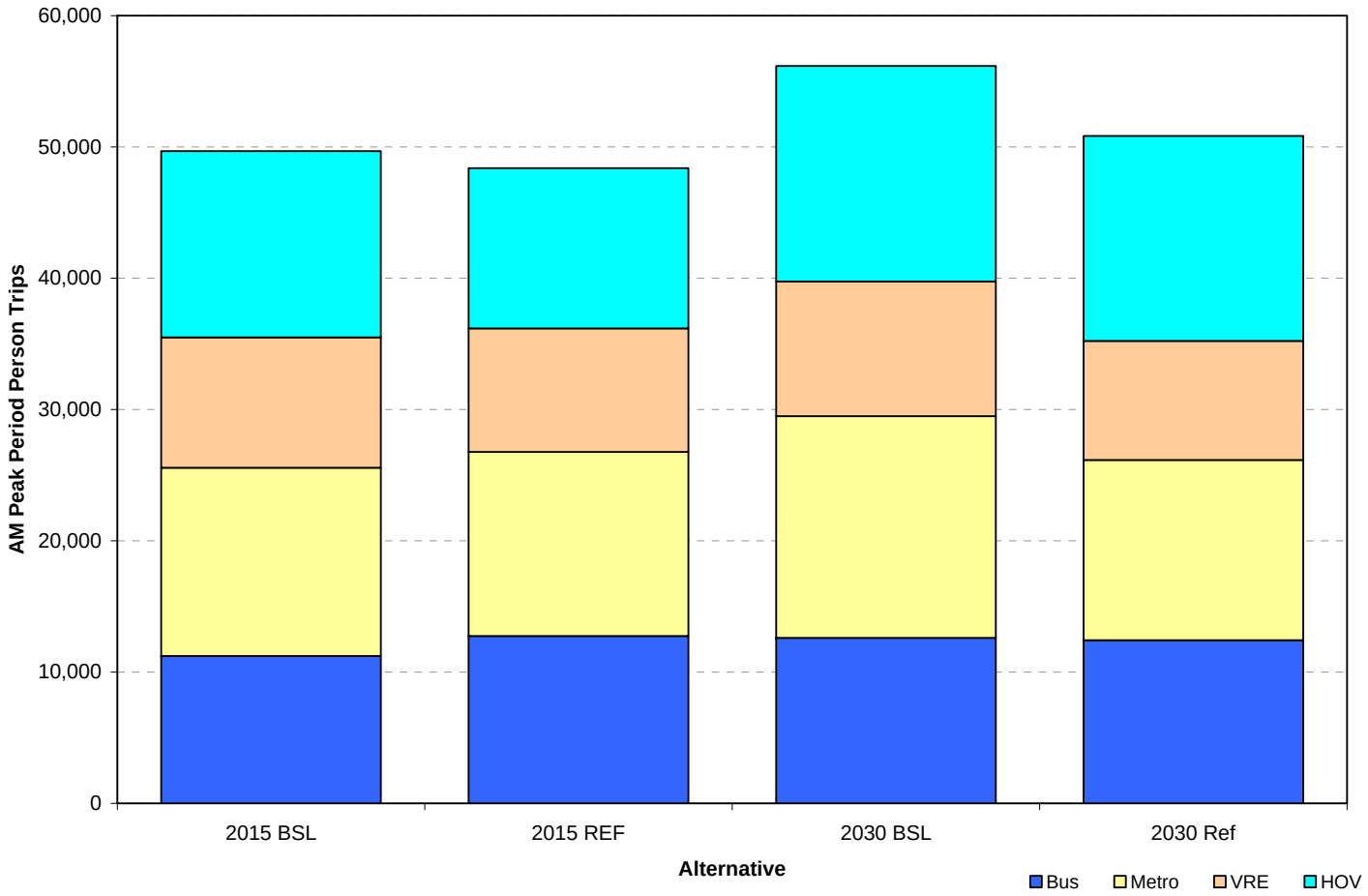

**LOV –** Low-occupancy vehicle
**MB –** Motor bus
**HR –** Metrorail heavy rail
**CR –** Commuter rail
**MB-HR –** Motor bus to heavy rail
**HOV –** High-occupancy vehicle
**BSL –** Baseline
**REF –** Refined Alternative

**Figure 5-7. Northbound Trips on I-95 at Beltway – Refined Alternative**




**VRE –** Virginia Railway Express
**HOV –** High-occupancy vehicle
**BSL –** Baseline
**REF –** Refined Alternative

**Figure 5-8. Northbound Trips on I-395 at Glebe Road – Refined Alternative**




**VRE –** Virginia Railway Express
**HOV –** High-occupancy vehicle
**BSL –** Baseline
**REF –** Refined Alternative

## *5.4 Other Sensitivity Analysis Scenarios*

The project and service elements of the sensitivity analysis for the Refined Alternative were represented in the inputs for the travel demand forecasting tools. This section presents a few key findings of the sensitivity analysis.

### 5.4.1 Scenarios Tested for Sensitivity Analysis

Four combinations of scenarios and horizon years were tested during the sensitivity analysis task of the project using the study model framework, as follows:

- The Refined Alternative represented good performing services and was developed from the tiered transit/TDM alternatives based on the model results and discussions with the TAC. The refined alternative was tested for both a 2015 and a 2030 horizon year;

- The BRAC land use scenario was tested with the transit/TDM elements that made up the Refined Alternative. The specific scenario tested reflected changes in socioeconomic data in the vicinity of the applicable Fairfax County and Quantico sites and used the study model framework to evaluate this alternative for a single horizon year of 2015; and

- The fare buy-down policy scenario was tested with the transit/TDM elements included in the Baseline Alternative for a single horizon year of 2030. The fare buy-down scenario was structured to apply to peak-direction transit services that are in the I-95/I-395 corridor (traveling northbound in the AM peak period and southbound in the PM peak period). The buy-down policy for the purpose of this analysis was assumed to be a 50 percent reduction in fares applicable to bus and VRE trips.

### 5.4.2 Sensitivity Analysis Mode Choice Results

The results of the analysis show that in the study area and from the study area to the core, there are small percentage changes in primary mode choice among the alternatives as compared to the baseline. In reviewing these forecasts, it is an important fact that the Baseline Alternative increases transit service significantly over existing levels and quality of service. All of the presented results show daily home-based work trips. This was the focus market in developing the transit/TDM alternatives as well as the refined alternative and other sensitivity analysis. Most of the differences among the performance of the proposed alternatives are in submode choice (i.e., shifts among bus, Metrorail, and commuter rail). The fare buy-down policy tested for year 2030 did show shifts in mode usage in the study corridor primarily from high-occupancy vehicle (HOV) to transit, but only a small shift from low-occupancy vehicles (LOV) to transit. Table 5-6 and Figures 5-9 and 5-10 summarize the results of the sensitivity analysis.

Figures 5-9 through 5-10 are summary charts which graphically show the results of the modeling effort. Figure 5-9 shows the study area mode share for 2015 and 2030. Figure 5-10 shows the mode share results for trips in the study area to the metropolitan core areas for both years 2015 and 2030.

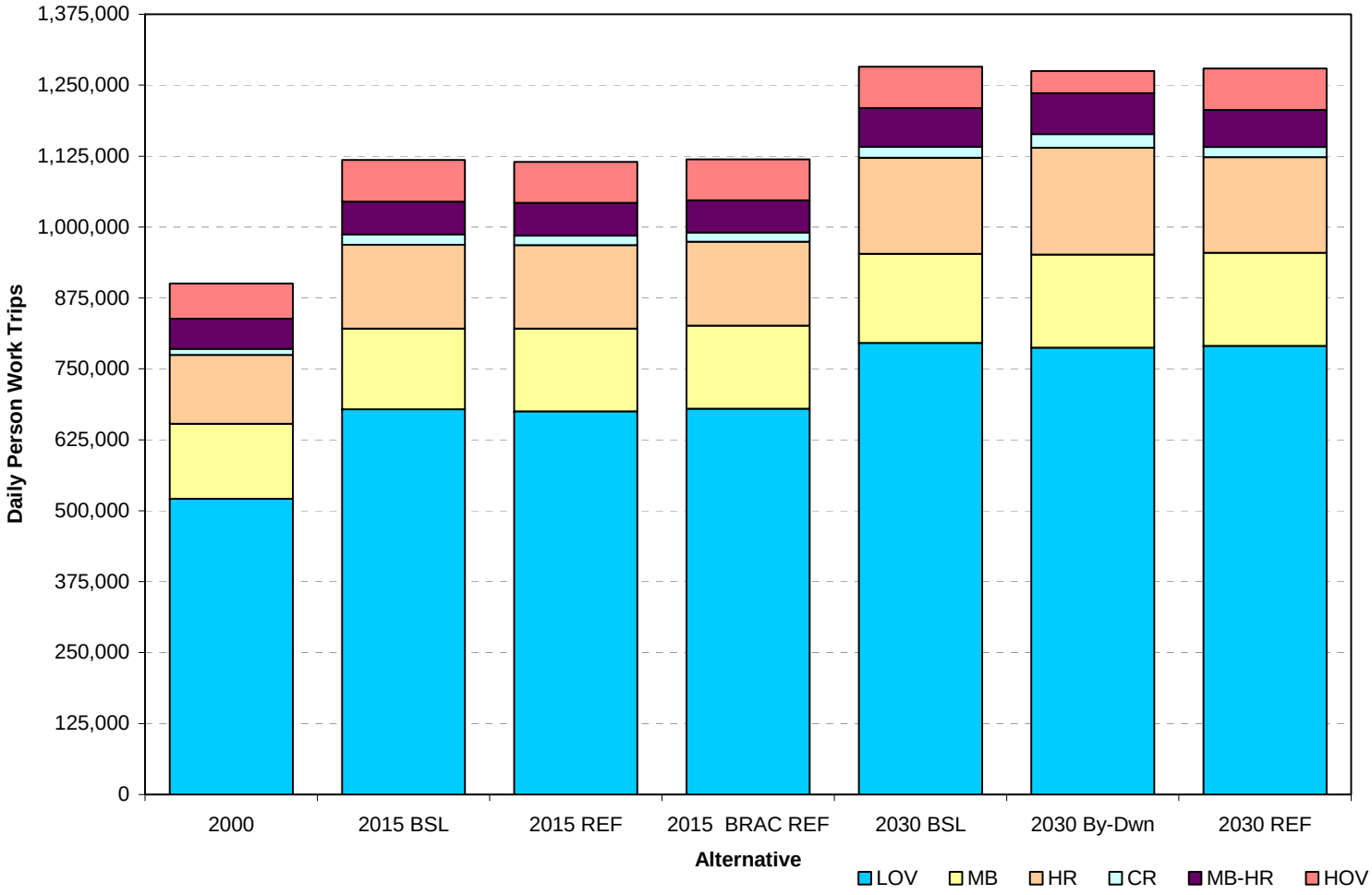
## Table 5-6. Mode Choice Results (Post-Processor) for Sensitivity Analysis

*Home-Based Work Trips*

| Mode | 2000 | 2015 Baseline | 2015 Refined | 2015 Refined BRAC | 2030 Baseline | 2030 Refined | 2030 Baseline Fare Policy |
|---|---|---|---|---|---|---|---|
| **Study Area** | | | | | | | |
| **LOV** | 520,791 | 678,819 | 675,268 | 679,858 | 795,818 | 790,722 | 787,331 |
| **TRN** | 317,851 | 365,902 | 367,384 | 367,424 | 412,418 | 415,795 | 448,588 |
| **HOV** | 61,668 | 73,437 | 72,351 | 72,027 | 73,003 | 72,828 | 39,392 |
| **Total** | **900,310** | **1,118,158** | **1,115,003** | **1,119,309** | **1,281,239** | **1,279,345** | **1,275,311** |
| **LOV** | 57.8% | 60.7% | 60.6% | 60.7% | 62.1% | 61.8% | 61.7% |
| **TRN** | 35.3% | 32.7% | 32.9% | 32.8% | 32.2% | 32.5% | 35.2% |
| **HOV** | 6.8% | 6.6% | 6.5% | 6.4% | 5.7% | 5.7% | 3.1% |
| **Study Area to Core** | | | | | | | |
| **LOV** | 100,442 | 115,674 | 114,977 | 114,068 | 116,553 | 115,951 | 97,332 |
| **TRN** | 225,176 | 248,867 | 248,952 | 250,957 | 274,330 | 275,598 | 305,739 |
| **HOV** | 33,597 | 40,299 | 39,478 | 39,292 | 36,394 | 36,273 | 23,497 |
| **Total** | **359,215** | **404,840** | **403,407** | **404,317** | **427,277** | **427,822** | **426,568** |
| **LOV** | 28.0% | 28.6% | 28.5% | 28.2% | 27.3% | 27.1% | 22.8% |
| **TRN** | 62.7% | 61.5% | 61.7% | 62.1% | 64.2% | 64.4% | 71.7% |
| **HOV** | 9.4% | 10.0% | 9.8% | 9.7% | 8.5% | 8.5% | 5.5% |

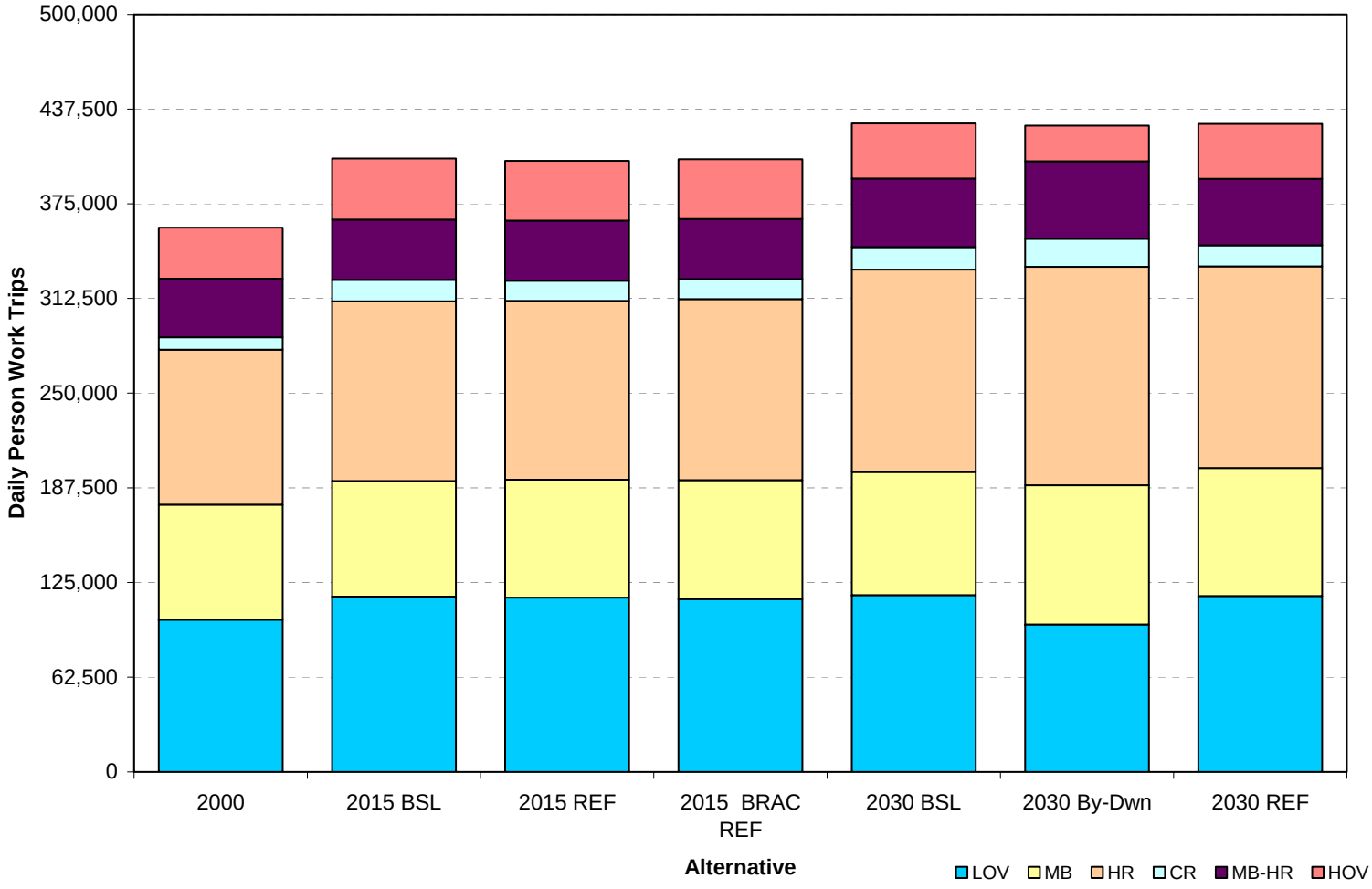
**Modes**
**LOV** Low-occupancy vehicle (less than three occupants)
**TRN** Transit
**HOV** High-occupancy vehicle (three or more occupants)

## Figure 5-9. Corridor Submode Share – Sensitivity Analysis




**LOV –** Low-occupancy vehicle **HR –** Metrorail or heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
**MB –** Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined alternative
**BRAC REF –** Base Closure and Realignment Commission sensitivity **By-Dwn –** Fare buy-down sensitivity

## Figure 5-10. Corridor Submode Share to Core – Sensitivity Analysis




**LOV –** Low-occupancy vehicle **HR –** Metrorail or heavy rail **MB-HR –** Motor bus to heavy rail **BSL –** Baseline
**MB –** Motor bus **CR –** Commuter rail **HOV –** High-occupancy vehicle **REF –** Refined Alternative
**BRAC REF –** Base Closure and Realignment Commission sensitivity **By-Dwn –** Fare buy-down sensitivity

### 5.4.3 Summary of Sensitivity Analysis Results

- The Refined Alternative performed as well as the Medium Alternative of the tiered transit/TDM alternatives, but at a lower total estimated cost.

- The BRAC model results showed an increase in LOV trips in the study corridor, but no significant change in mode shares.

- The fare buy-down showed a seven percent increase in transit mode share, but most of that came from the HOV market. A small percentage of the increase in transit mode share did come from the LOV market, but the cost of providing the buy down was prohibitive, especially given the limitations in achieving LOV reduction.

## *5.5 Appendix*

Appendix D provides an additional description of the model used and its validation. A series of summary origin-destination mode choice results maps are also presented in Appendix D. These maps depict the origin and destination flows of work trips for the morning peak period from major travel markets to major travel markets in the study area and the associated mode choice for the following scenarios and horizon years: 2015 Refined Alternative; 2015 BRAC; 2030 Baseline; and 2030 Refined Alternative.

# 6.0 Transportation Demand Management – Model Results

## *6.1 Overview of Methodology*

The transportation demand management (TDM) analysis estimated the reduction in single-occupant vehicle (SOV) trips that could be generated by implementing TDM strategies to encourage commuters who use I-95/I-395 for commuting to shift from SOV to carpooling, vanpooling, transit, and teleworking. The alternatives tested included a range of strategies grouped in the following general categories:

- Financial incentives for high-occupancy vehicle (HOV) modes:
  - Incentives for vanpools (capital cost, insurance, driver incentives, and start-up and empty seat subsidies); and
  - Incentives for carpools.
- TDM information and assistance services:
  - Park-and-ride and TDM information signage;
  - TDM/HOV marketing; and
  - Rideshare program support (e.g., additional staff for rideshare information assistance).
- Other rideshare support:
  - Guaranteed Ride Home service; and
  - Slug/casual carpool staging areas.
- Telework incentives for employers; and
- Electronic/tracking system support:
  - HOV/high-occupancy toll (HOT) lane transponders for vanpools; and
  - Carpool/vanpool mileage tracking.

As with the transit service analysis, the TDM strategy packages were tested at three levels: low; medium; and high. Higher-level packages added new strategies and/or enhanced programs.

The TDM strategies were assumed to be implemented areawide, rather than applied to specific routes/links on the transportation network, as was the case for the transit service analysis. However, most of the strategies were assumed to be targeted primarily to the residence areas in the southern section of the corridor and to residence areas that would be considered “feeders” to I-95 for commuting.

The primary estimation tool used for this analysis was the Federal Highway Administration (FHWA) Travel Demand Management (TDM) model. This model calculates expected SOV trip reduction and mode split for a sizeable range of TDM strategies, using a set of defined inputs and known starting trip and mode split conditions. Additional details of the model and how it was used in the analysis are provided in the next section of this document.

## 6.2 FHWA TDM Model Background

The Federal Highway Administration (FHWA) Travel Demand Management (TDM) model used for the analysis predicts changes in travelers' likelihood to use various modes of travel when offered particular TDM strategies. The model uses a pivot-point logit approach that begins with known travel conditions and a known mode split and predicts a revised mode split when TDM strategies are applied. The model was developed using data from numerous metropolitan regions in the United States and can be used with default assumptions set for metropolitan areas of various sizes and characteristics, but a desirable feature of the model is that it can be customized to use local calculation coefficients, if they are available. Thus, it offers an opportunity to tailor the analysis to be most representative of a particular area or region.

The model offers tools for analyzing both areawide and employer-based strategies. The model accommodates testing of strategies that provide a travel cost saving (e.g., financial incentives or parking charges) or time saving (e.g., transit frequency improvement or HOV lanes). Additionally, the model can be used to predict trip reduction from work hours arrangements (e.g., telework and compressed schedules) and from noncost and nontime TDM support services that make use of non-SOV modes more convenient or more desirable, but do not change the time or cost to use the modes. Several of these analysis options were used in the I-95/I-395 Corridor analysis.

The model also is designed to be used for a variety of situations, including a geographic subarea, a metropolitan area (with limitations), and an individual work site. The geographic subarea is most applicable to the I-95/I-395 corridor TDM analysis, because most of the TDM strategies in the project are assumed to be offered across a subset of Northern Virginia jurisdictions, but primarily to the traveling public at large, rather than to individual employer work sites.

As noted earlier, the analysis assumed that some strategies would be offered in or targeted to distinct portions of the study area and the model permits the user to define both origin and destination areas for the analysis. This feature also was used in the analysis to fine-tune the application of the strategies.

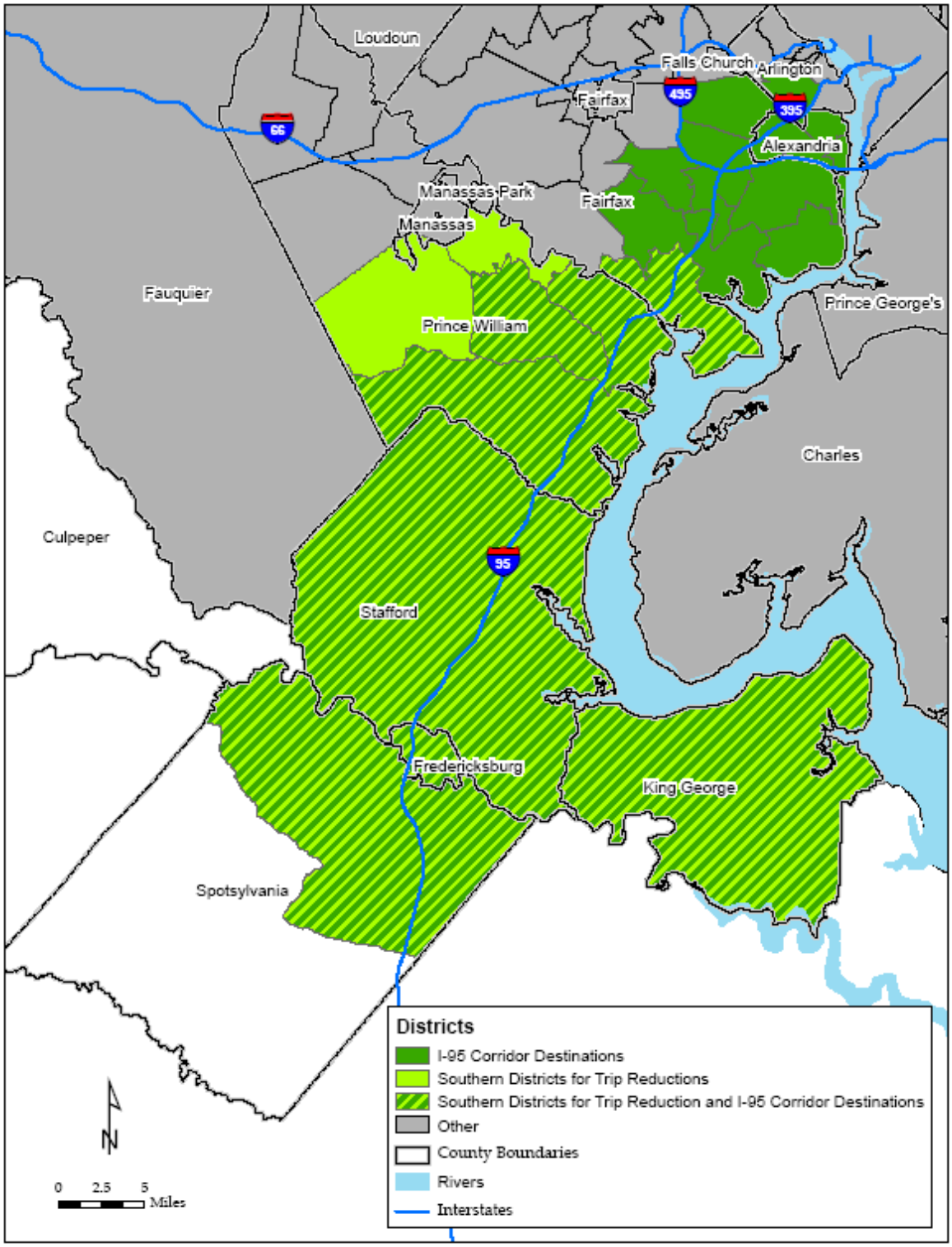
## 6.3 Model Inputs

The TDM model predicts change in vehicle trips from a set of starting travel conditions that include person, vehicle, and transit trips by origin-destination (O-D) pairs for home-based work (HBW) AM peak trips. In this analysis, the 2,191 TAZs of the Metropolitan Washington Council of Government (MWCOG) model were combined into 66 districts, due to model limitations and ease of interpreting the results.

Another adjustment was made to the trip tables prior to running the TDM model to remove trips assumed to be reduced by TDM strategies that could not be modeled, such as TDM marketing. This was done by applying trip reduction factors to account for TDM program marketing, ride-share program operational support, telework program assistance, and the enhanced guaranteed ride home program. These factors were applied to trips originating in the southern districts, which include eastern Prince William County, Stafford County, Fredericksburg, King George County, and northern Spotsylvania County to avoid double counting marketing efforts by MWCOG, as shown in Figure 6-1, labeled "Southern Districts for Trip Reduction." The trip reduction factors were developed using professional experience with the local market, as described in Appendix B.

Because the study area is larger than the actual I-95/I-395 highway corridor, trips originating and ending outside the actual corridor were removed from the analysis process. The destinations used in the TDM model were limited to the actual corridor. Figure 6-1 shows the corridor destinations.

## Figure 6-1. TDM Analysis Origin and Destination Districts



The second set of inputs to the TDM model was for the specific strategies to be tested. The two strategy types analyzed using the TDM model were vanpool and carpool incentives. The TDM strategies applied and how they were translated into the TDM model inputs are shown in Tables 6-1 through 6-3. The detailed assumptions used in developing the strategy model inputs are described in Appendix B.

Several elements were determined not to be explicitly represented with the FHWA TDM model, including electronic toll transponders for vanpools, TDM program signage, signage in park-and-ride lots, vanpool tracking, and the HOVER Pilot Program. Both the park-and-ride lot signage and the TDM program signage were assumed to be captured under the TDM programs marketing strategy, and the vanpool tracking and electronic toll transponders were assumed to have no direct benefit. The HOVER program does not have sufficient precedence to determine its impact on mode share.

## Table 6-1. TDM Elements in the Low Alternative

| Program Element | Description | Modeling Strategy |
|---|---|---|
| Carpool Incentives | Rewards and incentives for carpoolers. | $0.50/day/person subsidy. |
| Electronic Toll Transponders | Provide free electronic toll transponders to vanpools. | Insignificant to test in TDM model. |
| Rideshare Program Operational Support | Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| TDM Programs Marketing | Expand TDM marketing efforts in the corridor and feeder markets. New signage in park-and-ride lots and along corridor to promote TDM programs. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| Vanpool Driver Incentives | Provide financial incentives to attract new drivers and retain existing drivers for vanpools. | $1/vehicle subsidy. |
| Vanpool Insurance | Increase vanpool insurance premium pool buy-down for vanpools. | $2.80/day/vehicle subsidy. |
| Vanpool Tracking | Develop a tracking mechanism (GPS, cell phone) to track vans used for vanpools. | No benefit to vanpools, not tested in TDM model. |
| VanStart/VanSave | Financial support for vacant seats for new vanpools during start-up and established vanpools with temporary vacancies. | $12/vehicle subsidy. |

## Table 6-2. New and Revised TDM Elements in the Medium Alternative

| Program Element | Description | Modeling Strategy |
|---|---|---|
| Capital Cost of Contracting for Vanpools | Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital Cost of Contracting for Vanpools. | $12/vehicle subsidy. |
| Rideshare Program Operational Support | Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit. | Reduce vehicle trips originating in southern districts by 0.15 percent. |
| Telework Program Assistance | Financial incentives and assistance for employers. | Reduce person trips by 0.12 percent. |

## Table 6-3. New and Revised TDM Elements in the High Alternative

| Program Element | Description | Modeling Strategy |
|---|---|---|
| Capital Assistance for Vanpools | Provide financial assistance for the purchase or lease of vans for vanpools. | $4/vehicle subsidy. |
| Enhanced Guaranteed Ride Home Program | Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday. | Reduce vehicle trips originating in the southern districts by 0.1 percent. |
| HOVER Pilot Program | HOVER is a facilitated “park-and-ride-share” system that involves tracking of all participants’ usage and sharing of costs and benefits through a combination of financial and “HOVER Ride Credit” accounts. Members earn credits for picking up passengers and passengers use their credits to ride. | No precedence from which to establish the impact on mode share, and so not tested in the TDM model. |

## *6.4 TDM Model Results*

The TDM model was run six times, including a run for the low, medium, and high alternatives for each horizon years of 2015 and 2030.

The predicted trip reduction for each run was calculated by dividing the output morning peak home-based work (HBW) vehicle trip tables from the TDM model by the original MWCOG model vehicle trip tables. This produced single-occupancy vehicle trip reduction factors to account for mode shifts caused by each of the TDM measures applied. Overall, the trip reduction rates exhibited very similar behavior across all six model runs.

Table 6-4 gives more detail on the statistics of the trip reduction factors by model run, shown as a percentage reduction of single-occupancy vehicle trips over all O-D pairs, as well as total trips reduced.

## Table 6-4. Single-Occupancy Vehicle Trip Percent Reduction Rates

| | 2015 | | | 2030 | | |
|---|---|---|---|---|---|---|
| | **Low** | **Medium** | **High** | **Low** | **Medium** | **High** |
| Minimum | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Maximum | 68.0% | 68.0% | 75.0% | 75.0% | 75.0% | 75.0% |
| Average | 1.3% | 1.5% | 1.6% | 1.4% | 1.6% | 1.7% |
| Standard Deviation | 0.047 | 0.049 | 0.054 | 0.052 | 0.053 | 0.056 |
| **Total Trips Reduced** | **14,300** | **14,890** | **15,260** | **20,260** | **20,980** | **21,430** |

For example, the trip reduction for the low alternative for 2015 ranged from a low of 0.0 percent to a high of 68.0 percent across the range of O-D pairs. The average for all O-D pairs was 1.3 percent reduction for this alternative in 2015. The averages for the medium and high alternatives in 2015 were 1.5 and 1.6 percent reduction, respectively. For the 2030 case, the average reductions for the low, medium, and high alternatives were 1.4, 1.6, and 1.7 percent, respectively.

It is important to note that districts with large trip reduction factors typically had small base numbers of trips – a reduction of one or two trips in such cases causes a large percentage change. For this reason, it is most appropriate to use only the overall average reductions.

Table 6-4 also shows the total predicted daily SOV trips reduced for each alternative and analysis year. In 2015, the trips reduced ranged from 14,300 for the low alternative to 15,260 for the high alternative. In 2030, the total trips reduced ranged from 20,260 to 21,430.

Figures 6-2 and 6-3 graphically show the percent vehicle trip reduction rates for the low alternative in the year 2030, averaged over the origin end and the destination end, and are representative of the pattern of reductions seen for all alternatives. As illustrated in Figure 6-2, trip reduction rates were highest for origins in the southern portion of the study area. As shown in Figure 6-3 and as expected, the reverse was true for the destination areas; trip reduction rates were highest for destinations in the northern area of the study area.

At the end of this section, Figures 6-4 through 6-9 illustrate the total trips reduced throughout the modeled area. These graphics illustrate that the results are very similar for all three alternatives, with most of the reductions occurring in the southern districts of the corridor due to the higher program application in those districts. The single district encompassing Maryland and the District of Columbia also has a large number of trips reduced, which is due to the fact that the district is much larger than any of the other districts. The few districts which have no trip reductions are due to low numbers of trips originating and destined for those zones.

**Figure 6-2. Vehicle Trip Percent Reduction for 2030 Low-Alternative Origin Districts**

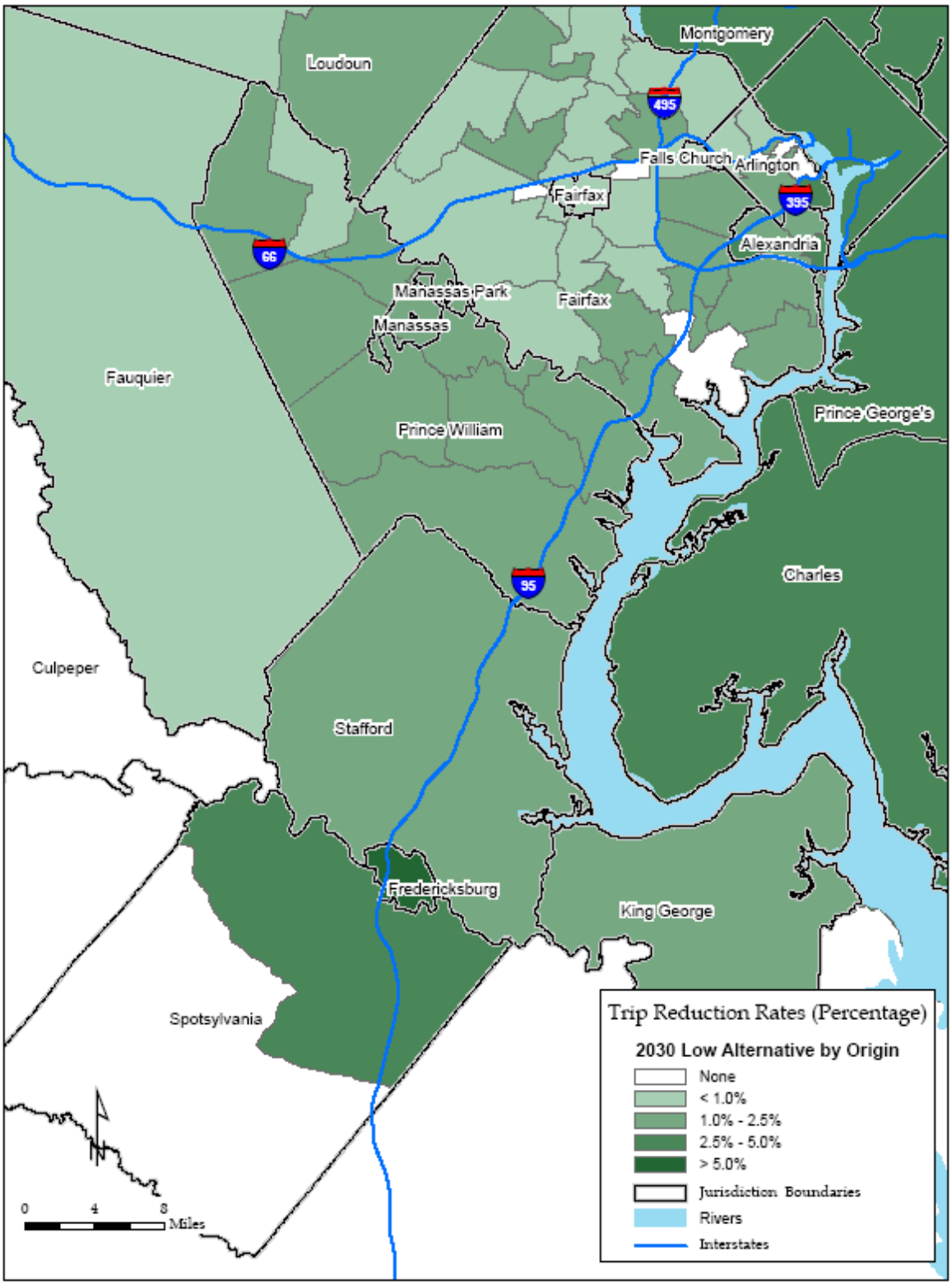


**Figure 6-3. Vehicle Trip Percent Reduction for 2030 Low-Alternative Destination Districts**

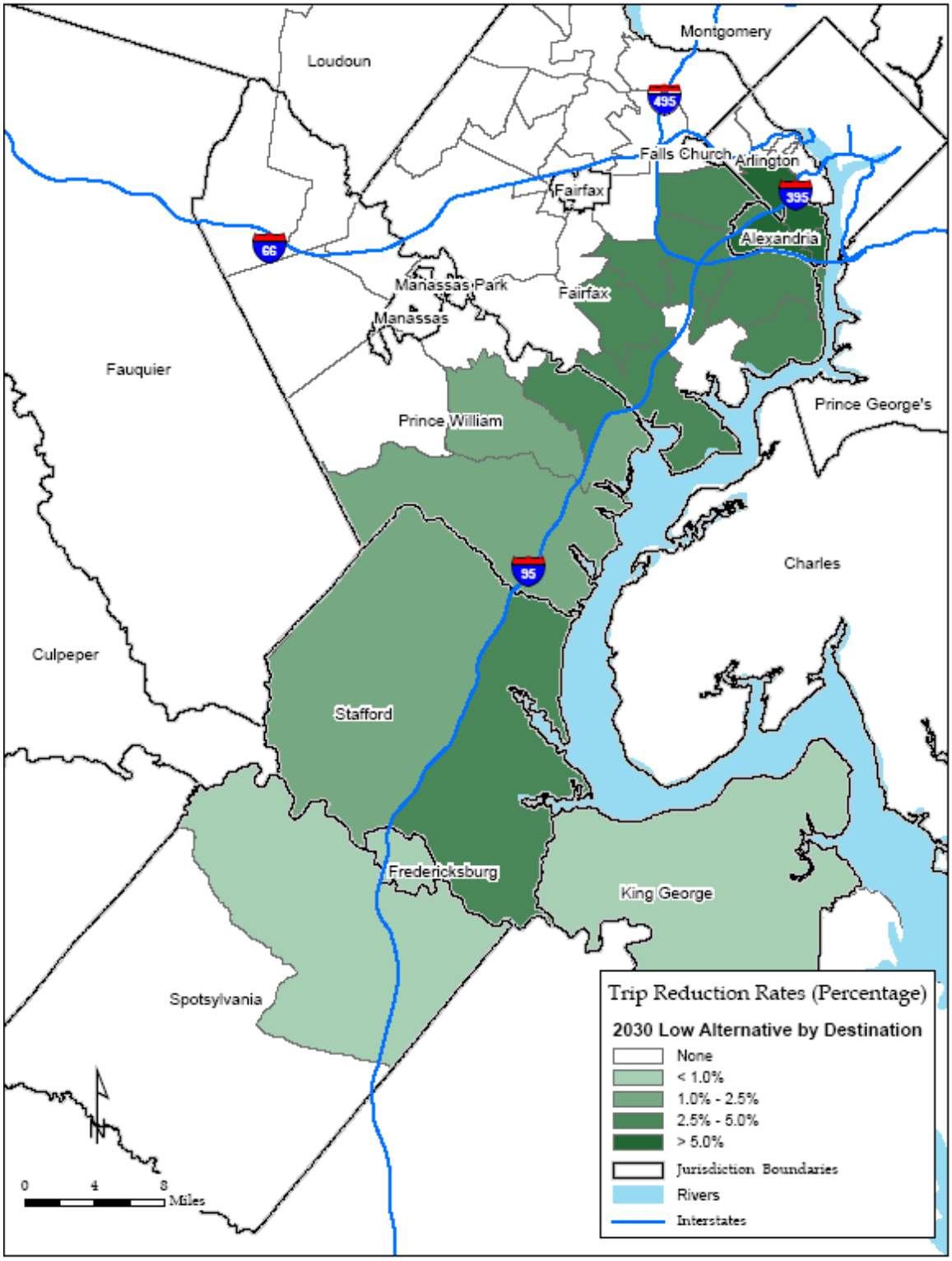


**Figure 6-4. Total Trips Reduced for 2030 Low-Alternative Origin Districts**

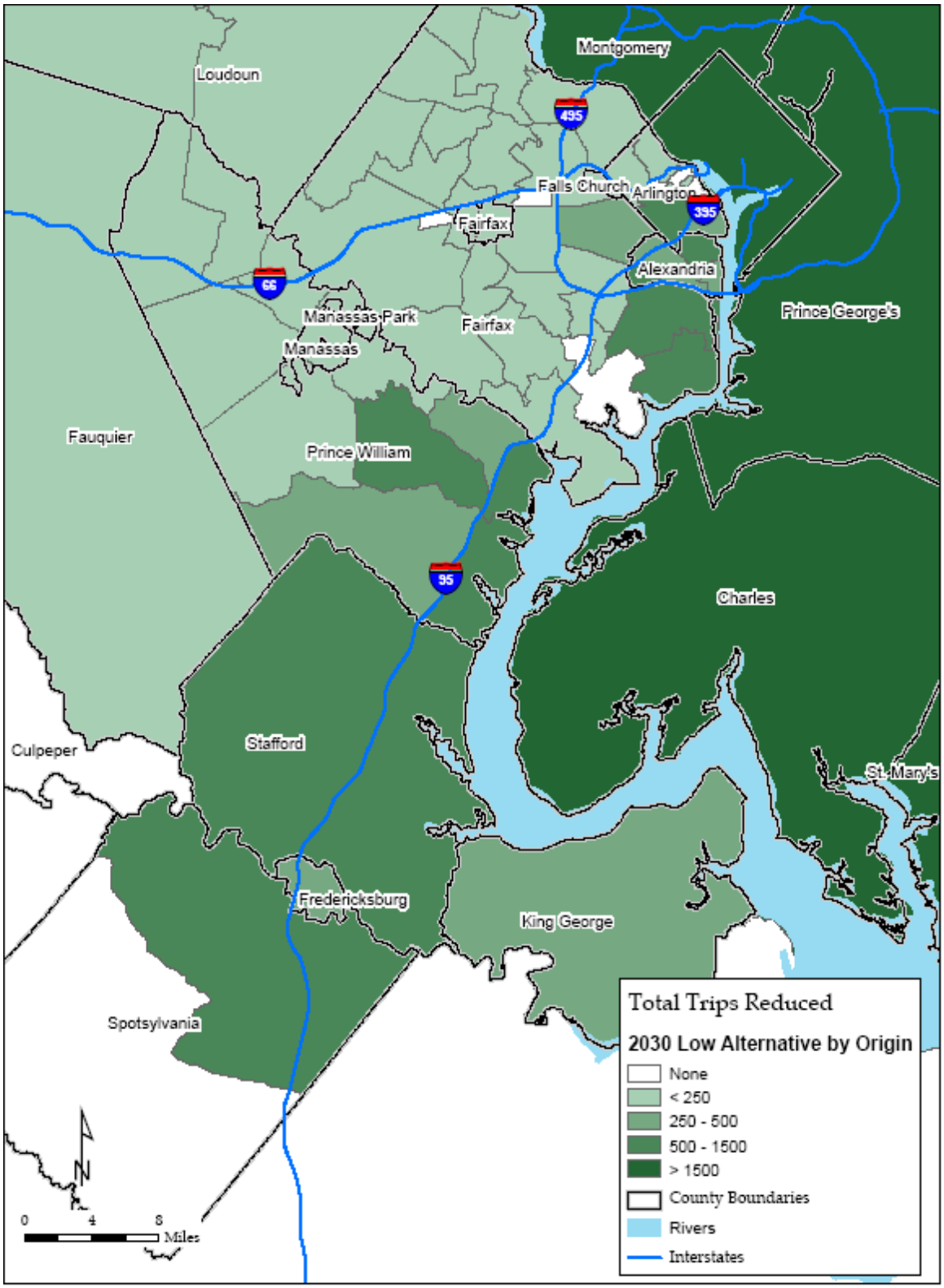


**Figure 6-5. Total Trips Reduced for 2030 Low-Alternative Destination Districts**

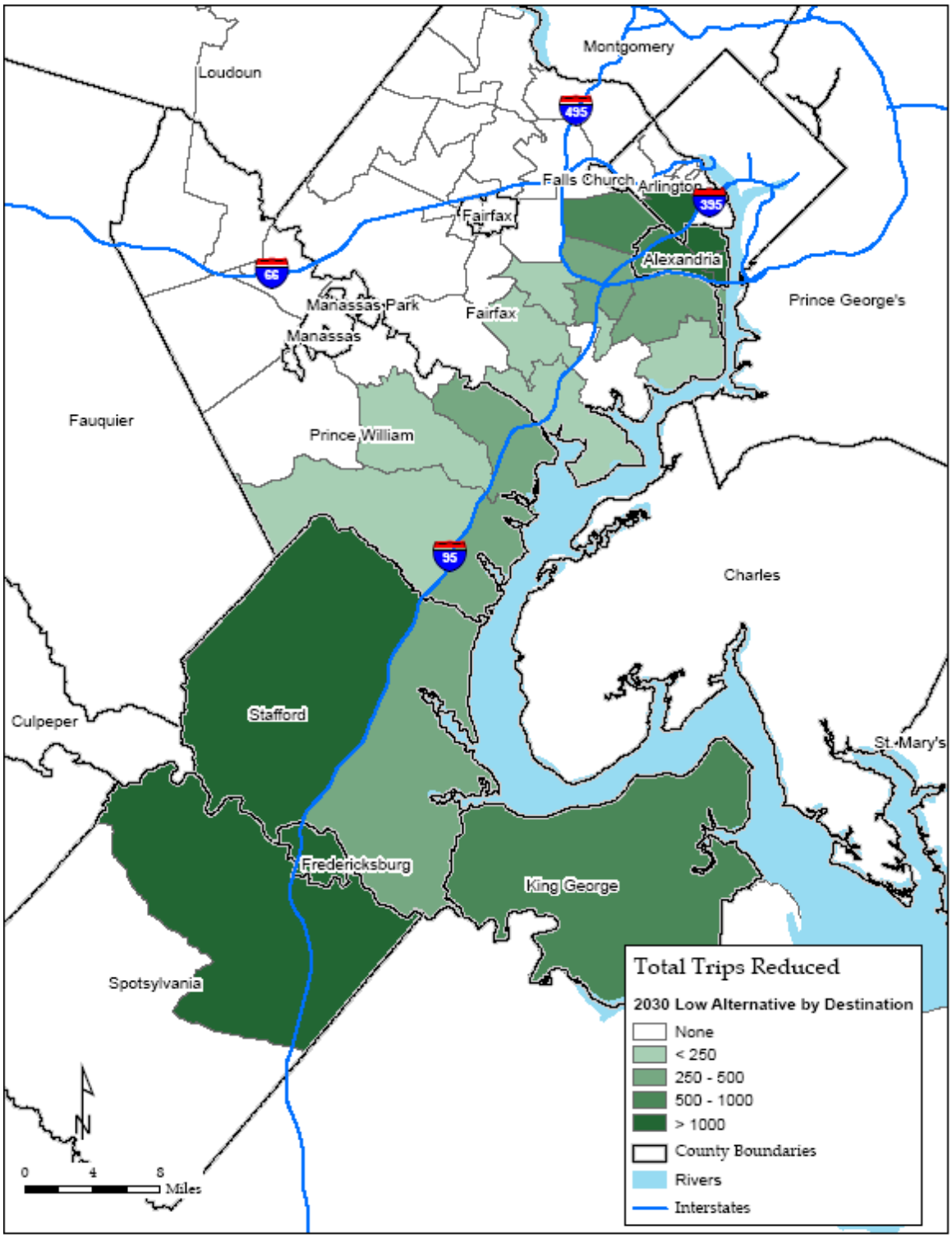


**Figure 6-6. Total Trips Reduced for 2030 Medium-Alternative Origin Districts**

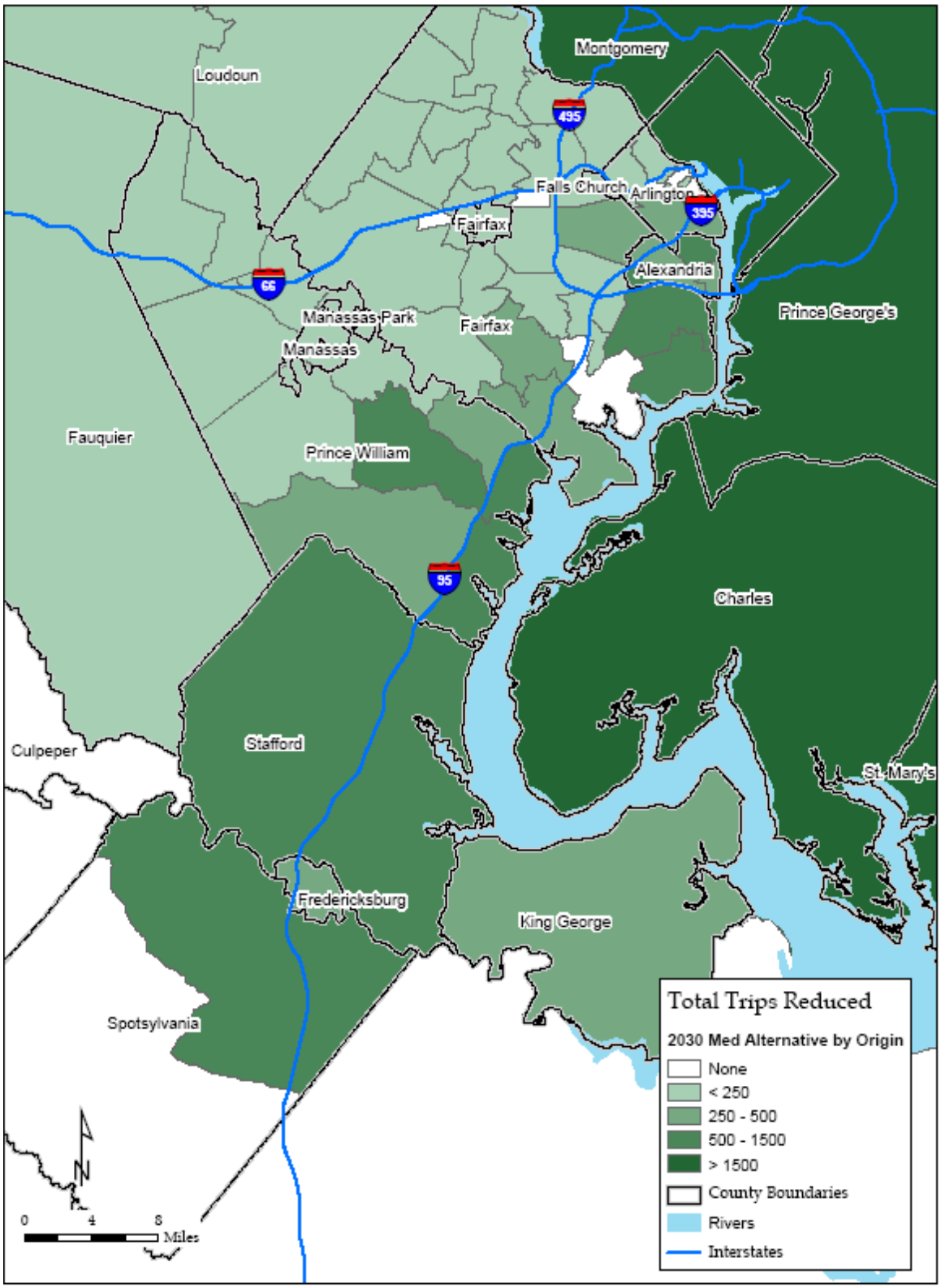


**Figure 6-7. Total Trips Reduced for 2030 Medium-Alternative Destination Districts**

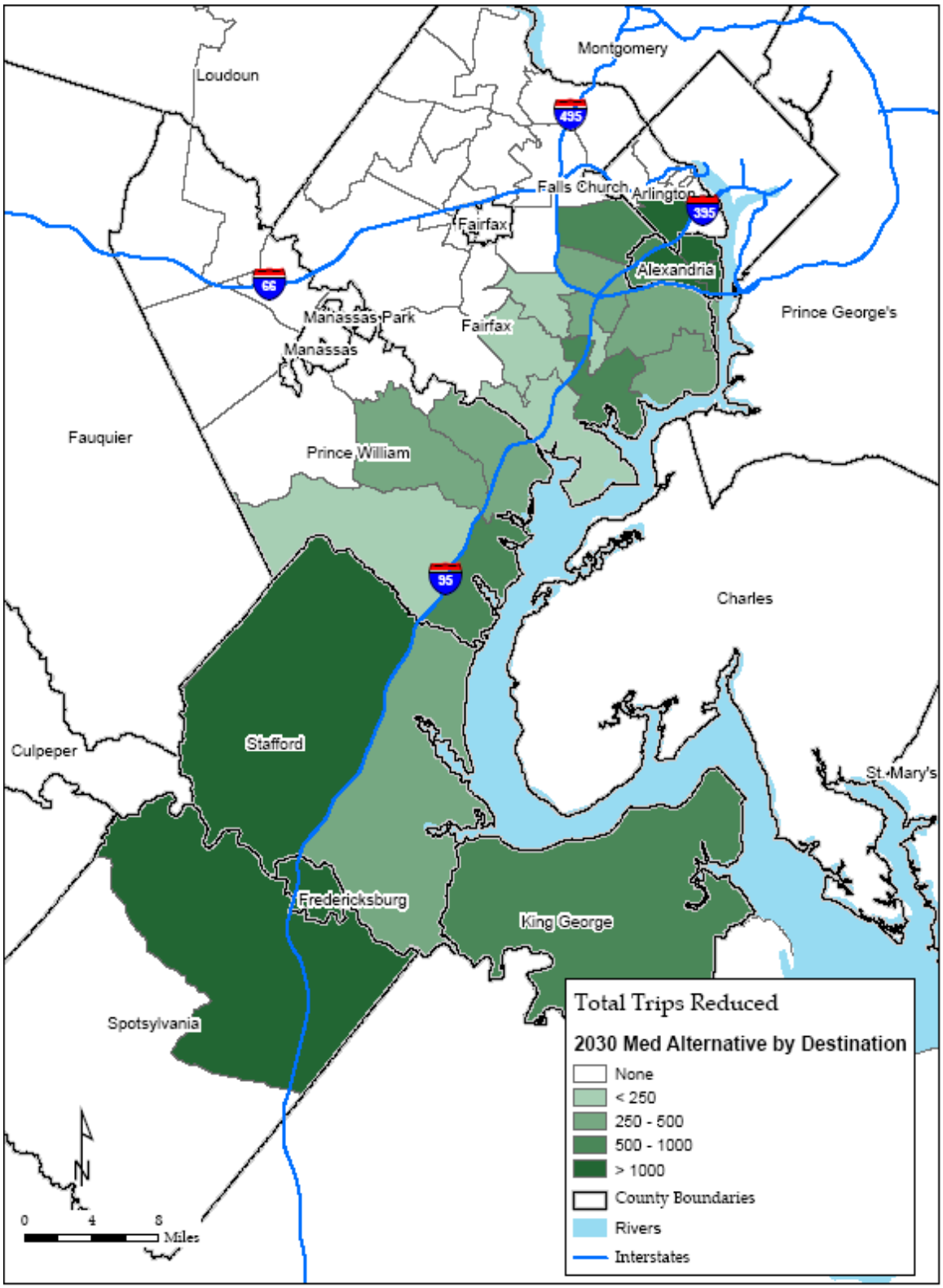


**Figure 6-8. Total Trips Reduced for 2030 High-Alternative Origin Districts**

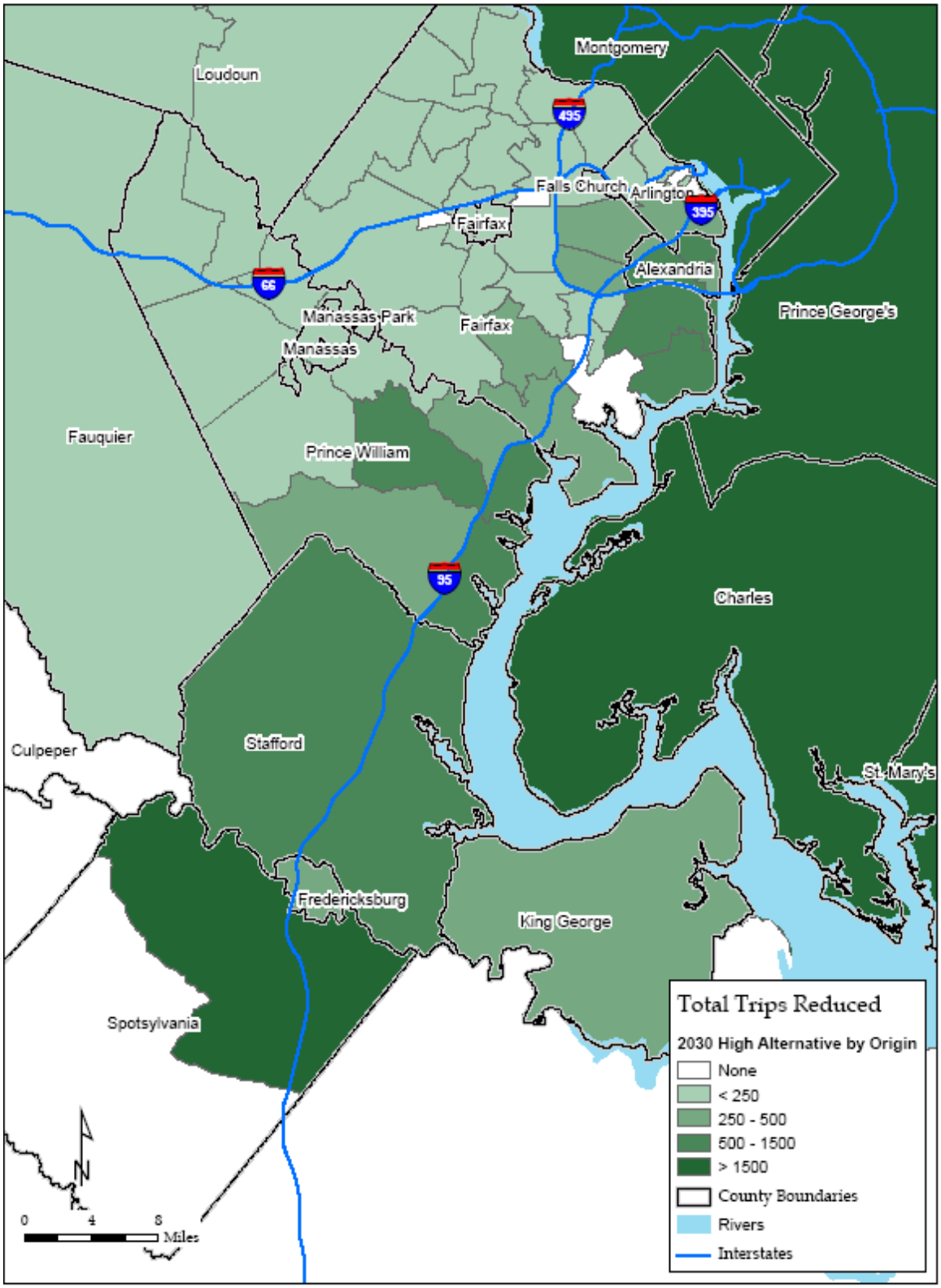
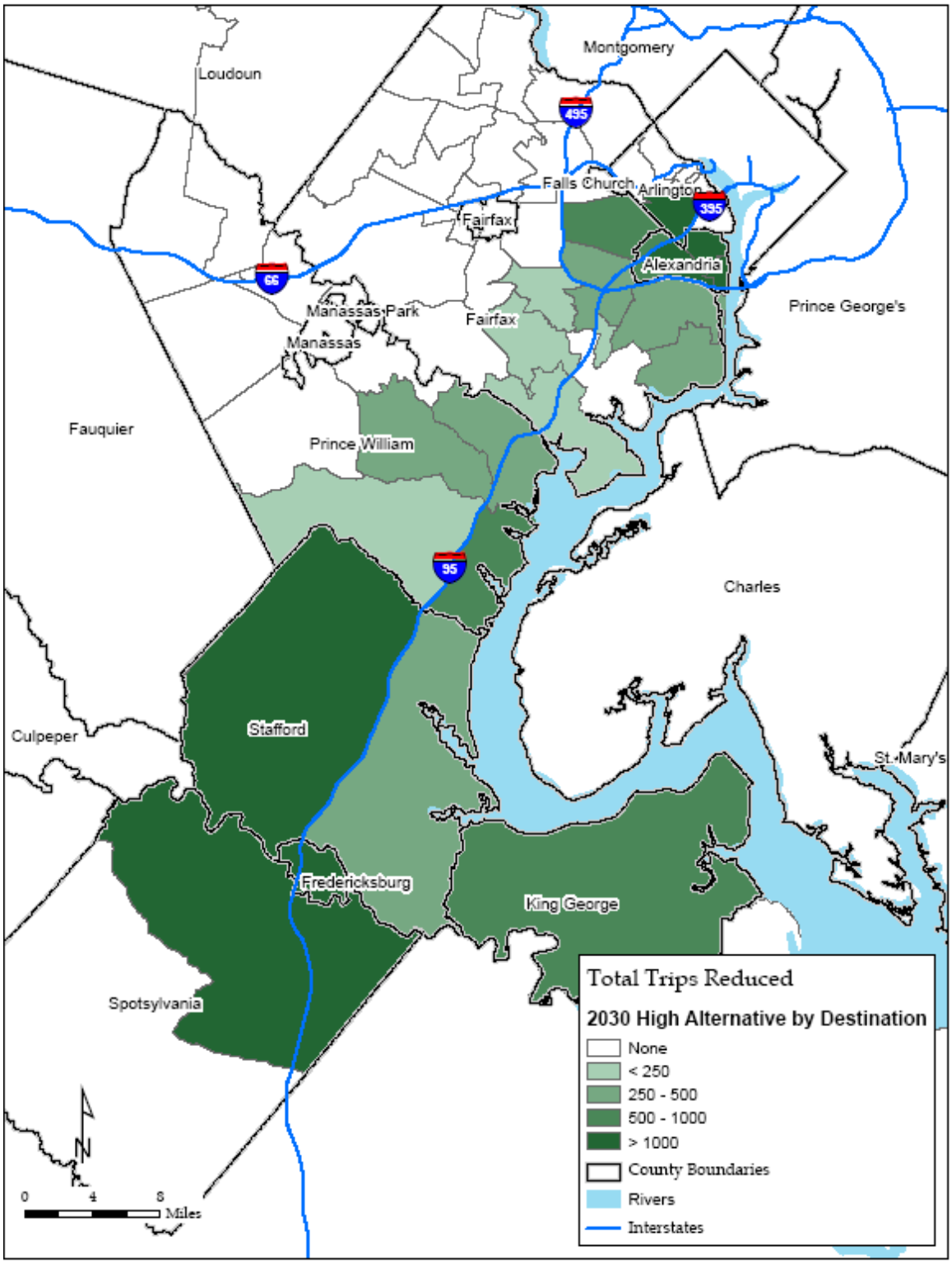


**Figure 6-9. Total Trips Reduced for 2030 High-Alternative Destination Districts**



## *6.5 Appendix*

A detailed description of the TDM model input assumptions appears in Appendix E.

# 7.0 Park-and-Ride Analysis

As part of the I-95/I-395 Transit/TDM Study, a comprehensive park-and-ride lot analysis was performed to determine the park-and-ride needs given the proposed HOT lane project for the corridor. This park-and-ride analysis focused on 38 lots in the I-95/I-395 study corridor. Included were bus and VRE-served lots and lots for carpool and vanpool users.

Table 7-1 shows the current utilization of lots in the corridor by lot name. The table reflects figures from a one-day usage count performed in 2006 at nearly all lots in the study area. Data for the Franconia-Springfield Metrorail Station were supplied by WMATA and were based on 2005 ridership data and responses regarding mode of access on the 2002 rail passenger survey. The parking counts and demand forecasts for the Franconia-Springfield Metrorail Station are included for information purposes (this lot was not included in the analysis). The recently opened lot at Backlick Road in Springfield is not included in Table 7-1 as it was not in use when the counts were completed, but the spaces were included in the needs analysis.

The total number of park-and-ride lot parking spaces in the study corridor is approximately 21,000 spaces. The current average utilization of these lots for year 2006 was approximately 86 percent.

## Table 7-1. Existing Lots – 2006 Count and Utilization

| Park-and-Ride Lots | 2006 Count | 2006 Capacity | Percentage Utilization |
|---|---|---|---|
| American Legion Post | 115 | 100 | 115% |
| Brittany Neighborhood Park | 63 | 85 | 74% |
| Brooke VRE | 358 | 431 | 83% |
| Dale City Commuter Lot | 295 | 591 | 50% |
| Franconia-Springfield Metrorail Station | 5,615 | 5,069 | 111% |
| Fredericksburg VRE | 767 | 702 | 109% |
| Gambrill Lot | 66 | 157 | 42% |
| Hechinger's Old Bridge | 505 | 580 | 87% |
| I-95/VA 123 Loop Interchange | 115 | 680 | 17% |
| K-Mart at Springfield Plaza | 51 | 50 | 102% |
| K-Mart Dale City | 62 | 240 | 26% |
| Lake Ridge Commuter Lot | 521 | 600 | 87% |
| Leeland Road VRE | 606 | 652 | 93% |
| Lorton VRE | 237 | 567 | 42% |
| Lorton PNR | 14 | 170 | 8% |
| Montclair Commuter Lot | 40 | 50 | 80% |
| Potomac Mills Mall | 1,057 | 936 | 113% |
| Prince William Parkway (Horner Road) | 2,364 | 2,317 | 102% |
| Prince William Square | 0 | 45 | |
| PRTC Transit Center | 156 | 200 | 78% |
| Quantico VRE | 170 | 258 | 66% |
| Rippon VRE | 345 | 676 | 51% |

**Table 7-1. Existing Lots – 2006 Capacity and Utilization (continued)**

| Park-and-Ride Lots | 2006 Count | 2006 Capacity | Percentage Utilization |
|---|---|---|---|
| Rolling Valley | 482 | 664 | 73% |
| Route 17 and Stanford Drive | 688 | 1000 | 69% |
| Route 208 and Houser Drive | 435 | 794 | 55% |
| Route 3 at VA 627 | 452 | 572 | 79% |
| Route 3 at VA 639 | 607 | 707 | 86% |
| Route 610 on Mine Road | 750 | 750 | 100% |
| Route 610 on Stafford Boulevard | 827 | 827 | 100% |
| Route 630 at I-95 | 478 | 523 | 91% |
| Springfield Mall | 23 | 80 | 29% |
| Springfield Mall Macy's Parking | 285 | 500 | 57% |
| Springfield Methodist Church | 69 | 57 | 121% |
| Springfield Plaza | 272 | 254 | 107% |
| Sydenstricker Road | 181 | 170 | 106% |
| Triangle | 29 | 29 | 100% |
| US1/VA 234 | 395 | 360 | 110% |
| Woodbridge VRE | 363 | 738 | 49% |
| **Total** | **19,850** | **23,181** | **86%** |

The lots included in the study are owned mostly by the Virginia Department of Transportation (VDOT), VRE, and the local counties. There are some lots in the corridor that are privately owned and provided to VDOT or to the local county government. These lots are provided as part of proffer agreements or by other arrangements. The park-and-ride lot at the Franconia-Springfield Metrorail Station is owned by WMATA.

## *7.1 Forecasting Methodology*

The methodology used to develop the forecasts for park-and-ride demand for the I-95/I-395 Transit/TDM Study was explicitly linked to the results of the postprocessor mode choice model. Understanding the market shed for trips which drive and park at lots in order to access transit, as well as those trips that drive to lots for carpooling and ridesharing activities, was important for addressing parking lot sizing, location, and the need for additional parking spaces. This approach is straightforward both in concept and application. It utilized the existing park-and-ride lot market shed survey information collected by VDOT as well as the MWCOG regional model, forecast data, and the WMATA postprocessor model choice model. This approach was applied to the park-and-ride lots that serve shared rides and bus modes. Park-and-ride lot demand for the commuter rail stations was developed directly from the results of the mode choice model, and the Franconia-Springfield Metrorail Station parking demand was supplied by WMATA.

The data requirements for this park-and-ride lot forecasting methodology were:

- Parking lot utilization data;
- License plate survey data;
- Forecast year drive access to transit and high-occupancy vehicle (HOV) demand forecasts; and
- Base year drive access to transit access and HOV demand forecasts.

This methodology applies a growth allocation approach based on the model results and the license plate survey data. The model calculates the forecast growth in drive access to transit and HOV trips between the base year and the forecast year from the postprocessor mode choice model. The growth is then applied to the existing parking count data to produce forecasts of drive access to transit and HOV-oriented trips to each park-and-ride lot in the I-95/I-395 study corridor. Figure 7-1 displays an overview flowchart of the process. The park-and-ride lots were aggregated into subareas for the purpose of analyzing future park-and-ride lot needs as well as reporting results. Figure 7-2 shows the subareas and the lots located within these subareas.

For the parking demand forecast, a series of 50 districts (aggregations of traffic analysis zones) in the I-95/I-395 corridor was developed. The park-and-ride lot districts were configured to approximate the likely market or travel shed that the traveler might consider when driving to a park-and-ride lot in the corridor. The districts were based on the data in the license plate survey. The growth factors that were used to grow the existing parking lot counts were calculated at the district level to smooth the variances among zones. This was done to address the issue of small changes in trips over the base creating relatively large factors, thus inflating the forecasts. Each park-and-ride lot in the corridor was assigned to a district for the application of the growth factors. The process developed specific demand estimates for each lot.

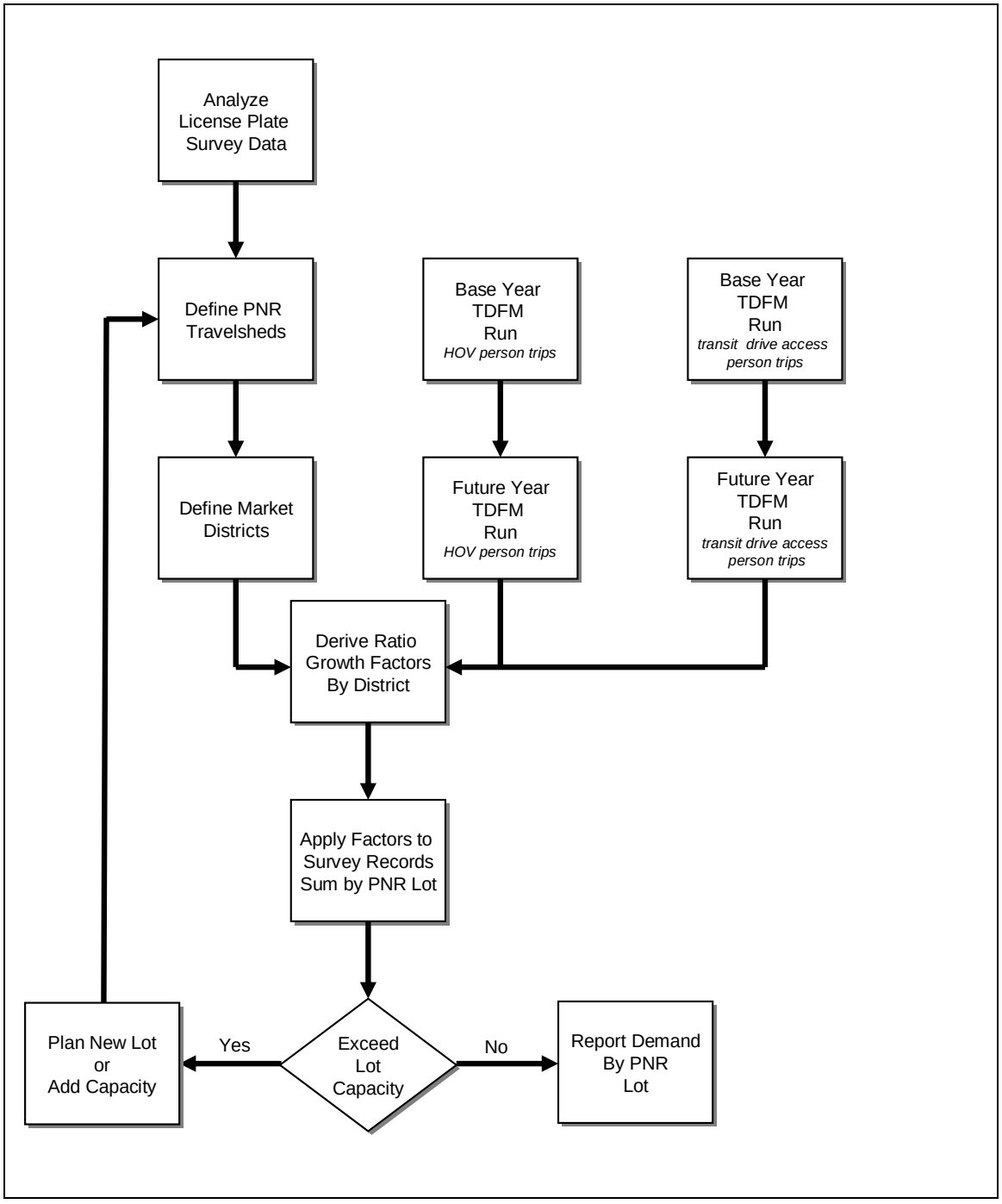
To assign the lots to districts, data from a park-and-ride lot license plate survey was used. The geocoded origin zone park-and-ride lot data from that survey were combined with a 2006 parking lot utilization survey to produce the baseline inputs to which the district-level growth factors were applied. Existing parking utilization for lots in the FAMPO area was provided and the origin zone of lot users was synthesized based on demographic data for the area. This was done because the southern lots were not included in the license plate survey.

The methodology assumed that future drive access and HOV drivers will choose a park-and-ride lot in the same travel shed that they do today. The lots were aggregated into subareas to help address the question of users shifting between lots. The rationale was that users will not shift to lots outside of the subareas they use today. The grouping also allows the study to better address the need for new spaces and lots within each subarea.

In determining the number of parking spaces required based on the forecast demand, it was assumed that future capacity improvements should result in approximately 90 percent maximum utilization of the subarea. Research shows the need to have some surplus at park-and-ride facilities to encourage use and provide some level of reliability. The analysis considered lots in the subareas that were over 90 percent utilization and proposed increasing the number of spaces until there was a 10 percent surplus.

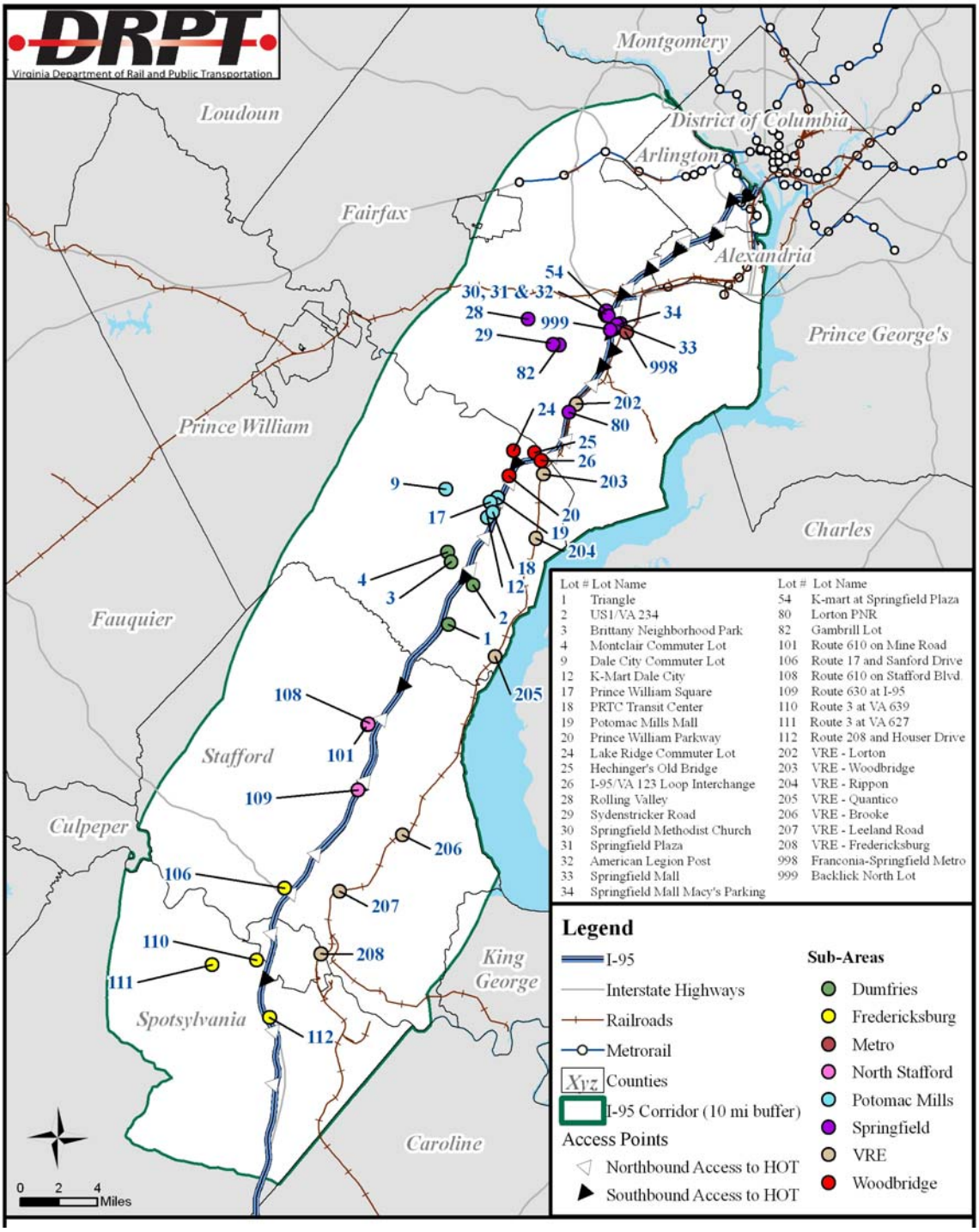
The analysis also recognized that some lots generate a unique synergy given their size and the level of transit service at the lot. This recognition applied to the Prince William Parkway (Horner Road) Lot. The demand for this lot was increased by 20 percent from the original forecast. This increase in demand was a recommendation of the TAC stakeholders. In order to balance this increase in the analysis process, the added 20 percent was assigned from other lots in the Woodbridge subarea to the Prince William Parkway (Horner Road) Lot.

## Figure 7-1. Park-and-Ride Forecasting Method Flowchart




Note: TDFM = Travel Demand Forecasting Model
PNR = Park-and-Ride Lot

**Figure 7-2. Existing Park-and-Ride Lots by Subarea**



Current leased lots which were part of the Springfield Interchange Congestion Management Program (CMP) were not included in the assessment of future available capacity due to the uncertainty associated with their availability in the future. This includes the American Legion Post, Springfield Plaza K-Mart, and the Springfield Macy's Garage. The deletion of the capacity for these lots was done under the recommendation of VDOT staff serving as TAC stakeholders based on the leasing agreements.

An adjustment factor was added to the demand projections for lots in the southern end of the study corridor. The factor was added to address the constraints of the model network and the impact of potential HOV external trips. A 10 percent factor was applied to the demand for these lots. It was derived from knowledge of the historic travel patterns in the area.

This analysis focused on drive to transit for bus service and HOV users. The VRE parking forecast was tied to the growth in the commuter rail home-based work trips represented in the results of the postprocess mode choice model. The forecast for the Springfield Metrorail station was provided by WMATA. This analysis did not focus on the Metrorail parking demands but did list the station parking needs in the results as was recommended by the TAC stakeholders.

## *7.2 Demand Forecasts*

Table 7-2 provides a summary of the parking demand and needs by subareas. The needs shown reflect the difference between forecasted demand and capacity within the subarea (with a 90 percent target utilization and rounded to the nearest 50 spaces) and supplemental recommendations by the TAC. Table 7-3 provides the demand forecast for each lot in the study area by subarea. The table lists the year 2006 usage and utilization as well as the percent of future demand to capacity. Figures 7-3 and 7-4 show the demand for the year 2015 and 2030 by lot.

The current year 2006 total demand for lots in the corridor was 20,014 while the current capacity was 23,351 spaces. This resulted in a corridor lot utilization of 86 percent. The year 2015 demand was estimated at 24,700 spaces and the year 2030 demand was estimated at 27,800 spaces. Figure 7-5 shows the demand in terms of required spaces by subarea by year.

## Table 7-2. Summary of Forecast Demand and Recommendations

| Subareas | 2006 Conditions | | | Forecast Demand | | Future Additional[a] | Future Capacity | Required 2030[b] | Recommendations |
|---|---|---|---|---|---|---|---|---|---|
| | Count | Capacity | Utilization | 2015 | 2030 | | | | |
| Dumfries | 527 | 524 | 101% | 700 | 700 | 500 | 1,024 | 500 | The planned expansion of the U.S. 1 at VA 234 lot addresses the future demand concerns for the Dumfries subarea. VDOT requested an additional 500 spaces due to a potential undercount for the current users at that lot. |
| Fredericksburg | 2,182 | 3,073 | 71% | 3,000 | 3,900 | – | 3,073 | 1,250 | Expand lot at U.S. 17 at Stanford Road – this lot serves HOV and transit commuters from the south headed to northern destinations. There should be an additional 300 spaces added to this lot. The lot will have a future in-line station and corresponding transit service. Add 650 spaces to the lot at VA 3 at VA 627 – there is available land at this location, and this will serve growing demand along VA 3 west of I-95. Add a 300 space lot to the Massaponax area where the HOT facility terminates. |
| Metrorail[c] | 5,615 | 5,069 | 111% | 5,800 | 6,300 | – | 5,069 | 1,925 | This demand is not being addressed as part of this study, but it is noted that there is additional demand for spaces at the Franconia-Springfield Metrorail Station based on WMATA's forecast. |
| North Stafford | 2,055 | 2,100 | 98% | 2,800 | 3,800 | – | 2,100 | 2,125 | Add a new 1,500 space lot in the vicinity of VA 610 at U.S. 1. A park-and-ride lot at this location will match-up with the proposed in-line station and provide connectivity to transit users. It will also serve as a gathering point for ridesharing activities. Also consider the addition of 625 spaces to the existing lot at VA 630 – there is ample land and future demand in that area |

[a] "Future Additional" column refers to additional capacity that has been committed to and funded. The information was provided by VDOT and represents VDOT and relevant jurisdiction commitments.

[b] "Required 2030" column represents the subarea need due to demand forecasted through the analysis (a 90 percent utilization target was used) or as determined by the TAC.

[c] Metrorail station park-and-ride usage and demand forecast was provided by WMATA.

## Table 7-2. Summary of Forecast Demand and Recommendations (continued)

| Subareas | 2006 Conditions | | | Forecast Demand | | Future Additional[a] | Future Capacity | Required 2030[b] | Recommendations |
|---|---|---|---|---|---|---|---|---|---|
| | Count | Capacity | Utilization | 2015 | 2030 | | | | |
| Potomac Mills | 1,570 | 2,012 | 78% | 1,700 | 1,900 | – | 2,012 | 500 | Add 500 spaces to PRTC Transit Center – this is the future site of an in-line station. Although there is a surplus of spaces at other lots in the subarea, with the proposed in-line station at the PRTC transit center additional parking is needed. |
| Springfield/ Lorton | 1,558 | 2,202 | 71% | 1,641 | 1,781 | -389 | 1,813 | 450 | Due to loss of leased lot spaces there is a need for additional spaces in the Springfield CBD area. |
| VRE | 2,846 | 4,024 | 71% | 4,900 | 4,900 | 619 | 4,643 | 1,475 | VRE station parking needs to be expanded to service parking demand or shuttle services need to be evaluated. Structured parking may be required at some sites due to lack of land availability. Stations with the highest demand are at the southern end of the study corridor. Specific stations have specific needs so demand at one station cannot be serviced by capacity at other. |
| Woodbridge | 3,505 | 4,177 | 84% | 3,900 | 4,200 | – | 3,588 | 1,500 | These spaces should be added at the Prince William Pkwy (Horner Road) lot. There is capacity in the subarea, but because of the activities at the Prince William Pkwy (Horner Road) lot there is a need for spaces there. |
| **Total Demand** | **20,014** | **23,351** | **86%** | **24,700** | **27,800** | **730** | **23,492** | **9,700** | |

[a] "Future Additional" column refers to additional capacity that has been committed to and funded. The information was provided by VDOT and represents VDOT and relevant jurisdiction commitments.

[b] "Required 2030" column represents the subarea need due to demand forecasted through the analysis (a 90 percent utilization target was used) or as determined by the TAC.

[c] Metrorail station park-and-ride usage and demand forecast was provided by WMATA.

## Table 7-3. Park-and-Ride Demand Analysis Individual Lot Demand

| | | 2006 Existing | | Forecast Demand | | Future Capacity | Demand to Capacity | | |
|---|---|---|---|---|---|---|---|---|---|
| Subarea | Name | Count | Capacity | 2015 | 2030 | 2030 | 2006 | 2015 | 2030 |
| Dumfries | Triangle | 29 | 29 | 40 | 40 | 29 | 100% | 138% | 138% |
| | US1/VA 234 | 395 | 360 | 510 | 570 | 860 | 110% | 59% | 66% |
| | Brittany Neighborhood Park | 63 | 85 | 80 | 80 | 85 | 74% | 94% | 94% |
| | Montclair Commuter Lot | 40 | 50 | 50 | 50 | 50 | 80% | 100% | 100% |
| Fredericksburg | Route 17 and Stanford Drive | 688 | 1,000 | 920 | 1,220 | 1,000 | 69% | 92% | 122% |
| | Route 3 at VA 639 | 607 | 707 | 840 | 1,080 | 707 | 86% | 119% | 153% |
| | Route 3 at VA 627 | 452 | 572 | 620 | 800 | 572 | 79% | 108% | 140% |
| | Route 208 and Houser Drive | 435 | 794 | 610 | 780 | 794 | 55% | 77% | 98% |
| Metrorail | Franconia-Springfield Metrorail Station | 5,615 | 5,069 | 5,770 | 6,300 | 5,069 | 111% | 114% | 124% |
| North Stafford | Route 610 on Mine Road | 750 | 750 | 1,030 | 1,390 | 750 | 100% | 137% | 185% |
| | Route 610 on Stafford Boulevard | 827 | 827 | 1,140 | 1,530 | 827 | 100% | 138% | 185% |
| | Route 630 at I-95 | 478 | 523 | 650 | 870 | 523 | 91% | 124% | 166% |
| Potomac Mills | Dale City Commuter Lot | 295 | 591 | 310 | 320 | 591 | 50% | 52% | 54% |
| | K-Mart Dale City | 62 | 240 | 70 | 80 | 240 | 26% | 29% | 33% |
| | Prince William Square | 0 | 45 | 0 | 0 | 45 | 0% | 0% | 0% |
| | PRTC Transit Center | 156 | 200 | 180 | 190 | 200 | 78% | 90% | 95% |
| | Potomac Mills Mall | 1,057 | 936 | 1,180 | 1,270 | 936 | 113% | 126% | 136% |

## Table 7-3. Park-and-Ride Demand Analysis Individual Lot Demand (continued)

| | | 2006 Existing | | Forecast Demand | | Future Capacity | Demand to Capacity | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subarea** | **Name** | **Count** | **Capacity** | **2015** | **2030** | **2030** | **2006** | **2015** | **2030** |
| Springfield | Rolling Valley | 482 | 664 | 500 | 540 | 664 | 73% | 75% | 81% |
| | Sydenstricker Road | 181 | 170 | 170 | 190 | 170 | 106% | 100% | 112% |
| | Springfield Methodist Church | 69 | 57 | 70 | 80 | 57 | 121% | 123% | 140% |
| | Springfield Plaza | 272 | 254 | 280 | 310 | 254 | 107% | 110% | 122% |
| | American Legion Post | 115 | 100 | Closed | | | 115% | | |
| | Springfield Mall | 23 | 80 | 20 | 30 | 80 | 29% | 25% | 38% |
| | Springfield Mall Macy's Parking | 285 | 500 | Closed | | | 57% | | |
| | K-Mart at Springfield Plaza | 51 | 50 | Closed | | | 102% | | |
| | Lorton PNR | 14 | 170 | 330 | 350 | 340 | 50% | 97% | 103% |
| | Gambrill Lot | 66 | 157 | 70 | 80 | 157 | 42% | 45% | 51% |
| | Backlick North Lot (NEW) | 0 | 0 | 475 | 510 | 261 | | 182% | 195% |
| VRE | Lorton | 237 | 567 | 400 | 410 | 567 | 42% | 71% | 72% |
| | Woodbridge | 363 | 738 | 620 | 630 | 738 | 49% | 84% | 85% |
| | Rippon/Cherry Hill | 345 | 676 | 590 | 600 | 1,176 | 51% | 50% | 51% |
| | Quantico | 170 | 258 | 290 | 290 | 308 | 66% | 94% | 94% |
| | Brooke | 358 | 431 | 610 | 620 | 500 | 83% | 122% | 124% |
| | Leeland Road | 606 | 652 | 1,030 | 1,050 | 652 | 93% | 158% | 161% |
| | Fredericksburg | 767 | 702 | 1,310 | 1,330 | 702 | 109% | 187% | 189% |
| Woodbridge | Prince William Parkway (Horner Road) | 2,364 | 2,317 | 2,630 | 3,390 | 2,317 | 102% | 114% | 146% |
| | Lake Ridge Commuter Lot | 521 | 600 | 540 | 340 | 600 | 87% | 90% | 57% |
| | Hechinger's Old Bridge | 505 | 580 | 550 | 360 | 580 | 87% | 95% | 62% |
| | I-95/VA 123 Loop Interchange | 115 | 680 | 140 | 90 | 680 | 17% | 21% | 13% |
| **Total** | | **20,014** | **23,351** | **24,610** | **27,760** | **24,731** | **86%** | **100%** | **112%** |

**Figure 7-3. Park-and-Ride Lots Demand – Based on 2015 Refined Alternative**

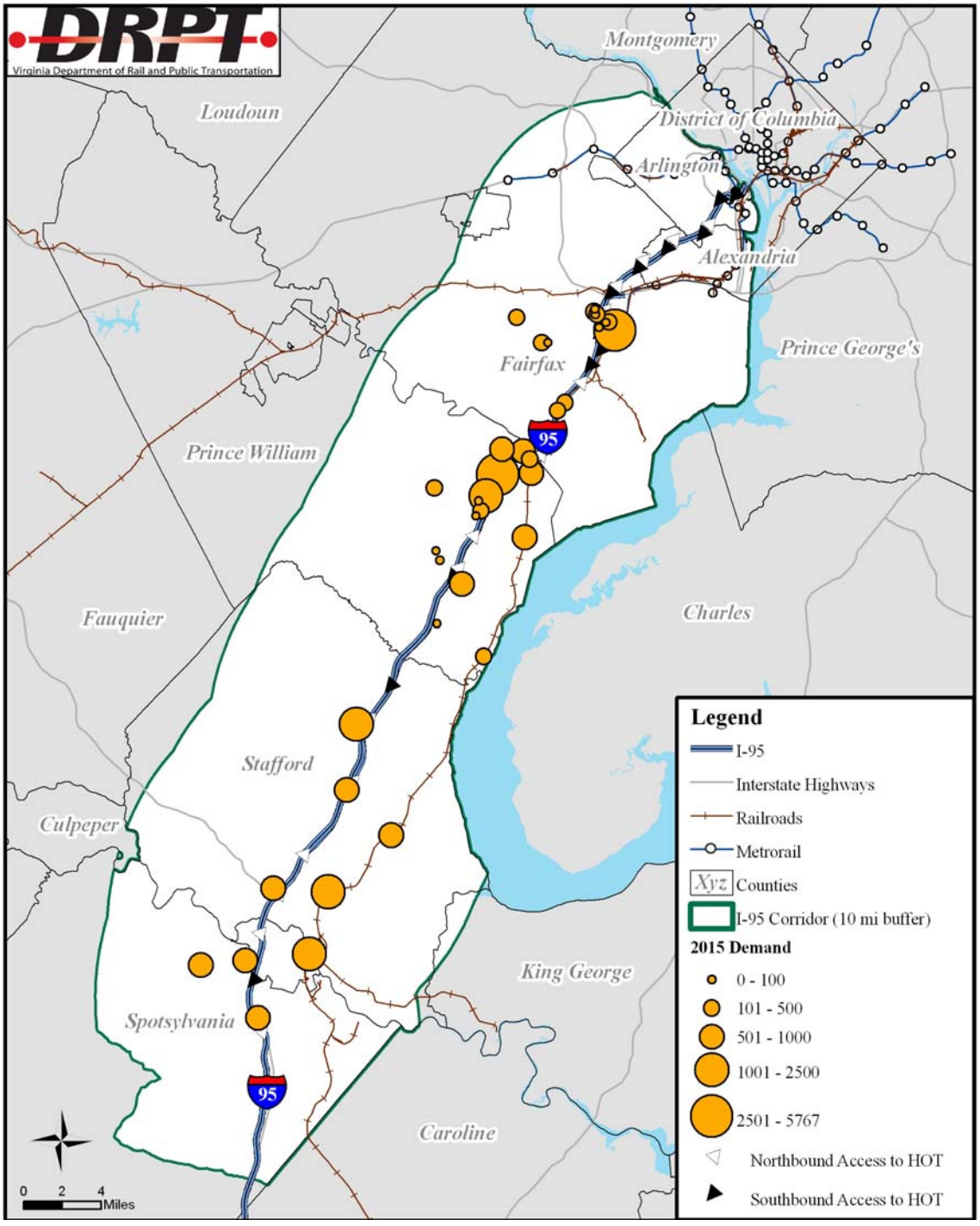
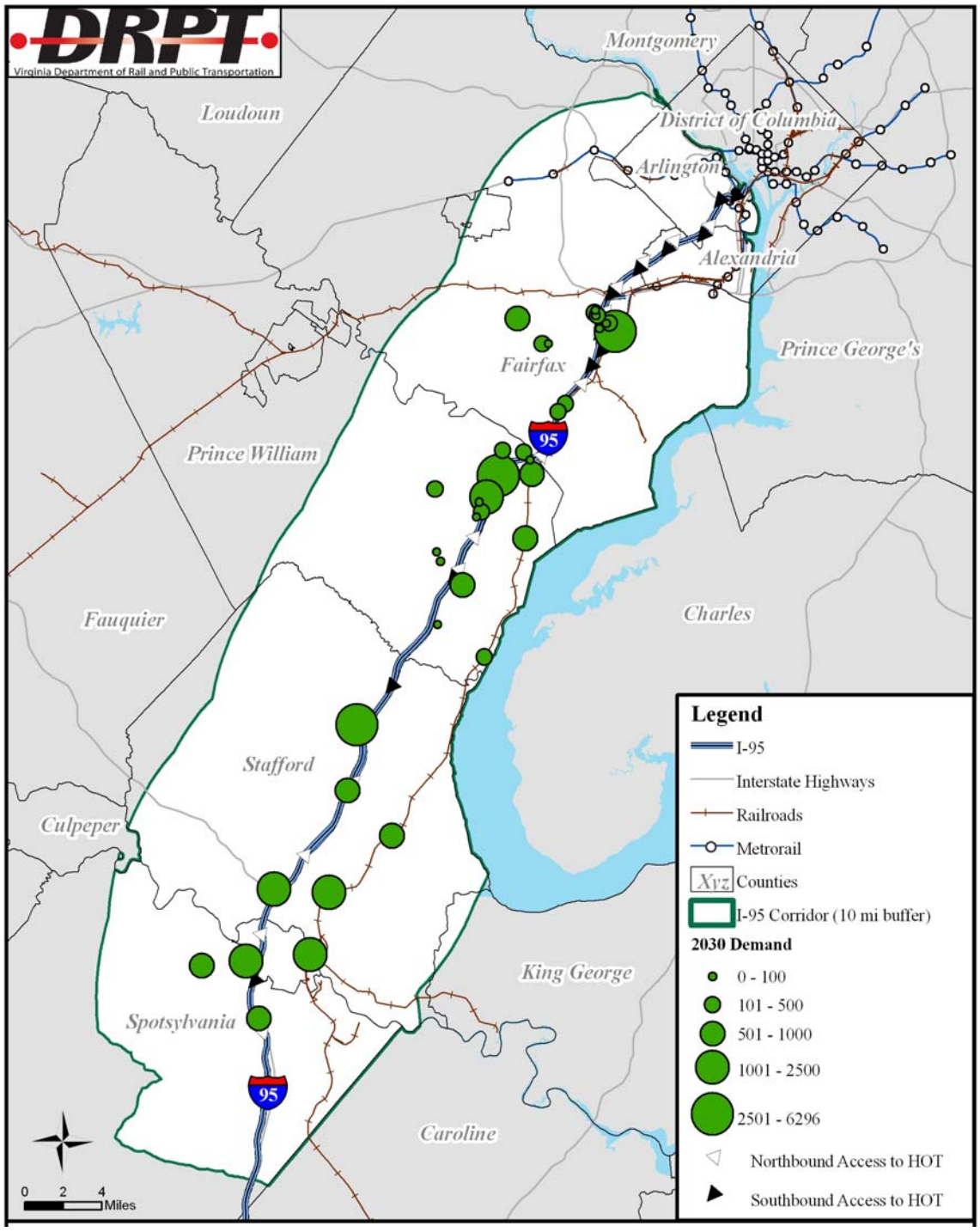
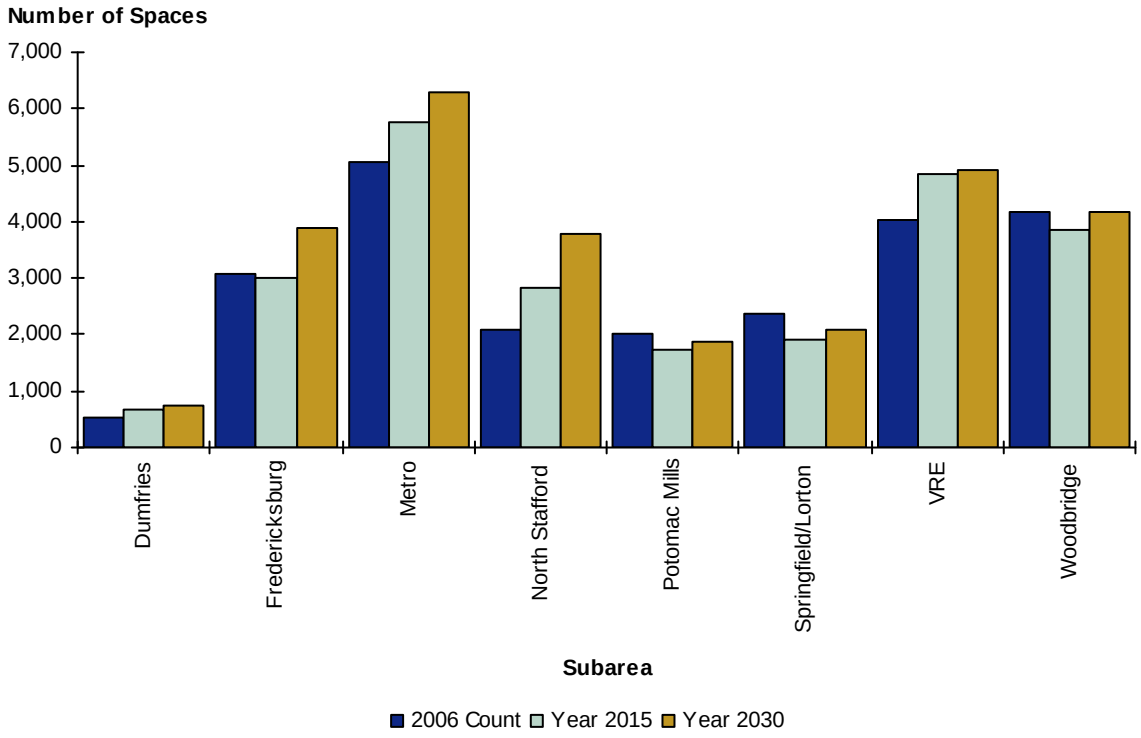


**Figure 7-4. Park-and-Ride Lots Demand – Based on 2030 Refined Alternative**



## Figure 7-5. Park-and-Ride Lot Demand Forecasts



## *7.3 Recommendations for Expanded Capacity*

The forecast demand for the park-and-ride lots was integrated with the travel demand forecast modeling. The lots were aggregated to park-and-ride subareas. These subareas were based on geography referenced in Figure 7-2. The subareas were:

- **Dumfries –** Southern Prince William County;
- **Fredericksburg –** Southern Stafford County to Spotsylvania County;
- **Metrorail –** Franconia-Springfield Metrorail Station;
- **North Stafford –** South of Quantico to VA 630;
- **Potomac Mills –** The area around Potomac Mills Shopping Center and the PRTC transit center;
- **Springfield/Lorton –** The area of Fairfax County south of the Beltway (I-495/I-95) in the study corridor;
- **VRE –** All VRE stations on the Fredericksburg Line south of Springfield; and
- **Woodbridge –** South of the Occoquan River and north of Dale Boulevard.

The purpose of the subareas was to evaluate the demand for a specific location and allow for that demand to be balanced with available capacity in the surrounding area. If a certain lot was over capacity and there were lots located nearby, then the available capacity could be balanced with the subarea demand needs. This approach allowed for excess capacity in the subarea to service the required demand and fully utilized existing resources in the surrounding vicinity. In some subareas certain lots were recognized by the TAC stakeholders to have greater activity levels that therefore required additional spaces even when the adjacent lots had capacity. Overall the analysis balanced the needs of subarea as a whole with the available capacity. The commuter rail stations were treated differently in that the subarea for commuter rail covered the whole corridor. Station parking demand had to be addressed for each specific station along the line.

In developing recommendations for the Refined Alternative, the first priority in allocation of spaces was to provide parking for the proposed in-line stations. The second priority was to address areas with the largest difference between forecasted demand and forecasted capacity. The third priority was to minimize partial funding of park and ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots). In some subareas there was a need to recommend building new lots to meet demand. Given the characteristics of HOV rideshare users, the goal was not to create a new lot since existing lots have some inherent inertia around the ridesharing and slugging activities. Where new lots are proposed, transit service is programmed for these lots and should provide a backbone for slugging and ridesharing activities. Figure 7-6 shows the year 2030 parking needs by lot. This map represents the demand over the available or future programmed capacity for each lot.

The North Stafford subarea showed the largest need for new spaces. This subarea needs a total of 2,125 new spaces to meet the project year 2030 demand. Adding a new 1,500 space lot in the vicinity of VA 610 at U.S. 1 would serve the proposed in-line station needs as well as the growing HOV market in north Stafford County. A park-and-ride lot at this location will provide connectivity to transit and serve future HOV needs. The addition of 625 spaces to the existing lot at VA 630 should also be considered.

VRE shows the second-largest need for spaces given the growth of commuter rail riders in the study corridor. VRE needs a total of 1,500 spaces dedicated to the three stations at the southern end of the Fredericksburg Line. This would include 200 new spaces at the Brooke Station, 500 new spaces at the Leeland Road Station, and 800 new spaces at the Fredericksburg Station. Although there is a surplus of spaces for stations to the north there is still significant need for the southern stations. The proposed addition of a new station between Rippon and Quantico with 550 new parking spaces does help with demand in northern Stafford and southern Prince William Counties. The VRE subarea is different from the other subareas in that users of a specific lot are not likely to shift lots, rather they may shift modes. So, even with demand being met in the northern part of the corridor, there is still a need for improvements to the stations in the southern part of the corridor.

Based on the demand forecast analysis, the Fredericksburg subarea shows the third-largest need for spaces in the study corridor – 1,250 new spaces. Three recommendations result for this subarea. First, expand the lot at U.S. 17 at Stanford Road by 300 spaces as this lot serves HOV and transit commuters from the south headed to northern destinations. This lot will also have a future in-line station and corresponding transit service. Second, there is a substantial need along VA 3 west of I-95. An additional 650 spaces should be built at VA 3 at VA 627. Third, a 300 space lot should be located in the Massaponax area where the HOT facility terminates. This is the proposed location of the future transit center for the area.

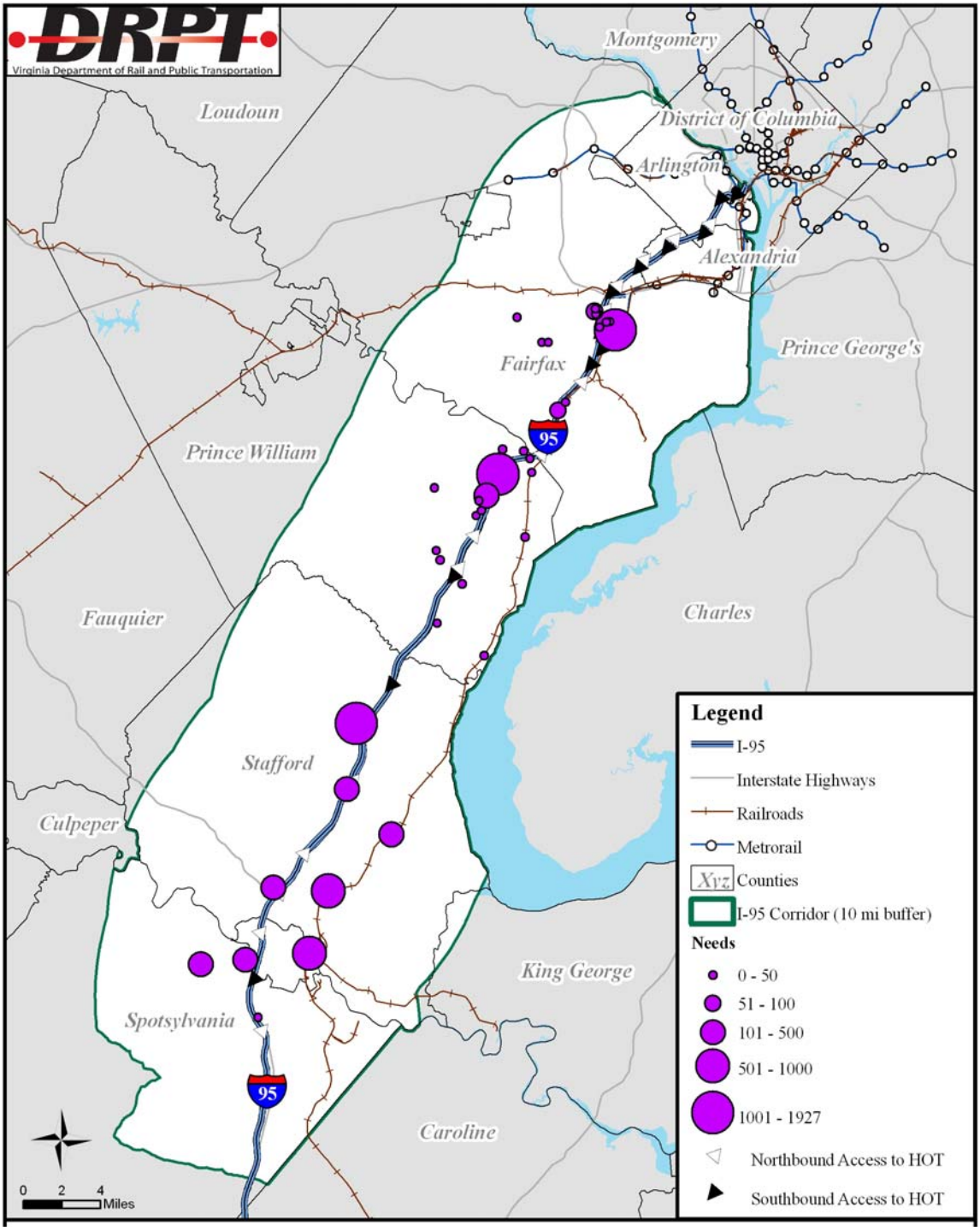
For the Woodbridge subarea there is a need for 1,450 spaces at the Prince William Parkway (Horner Road) lot. The stated need at this lot reflects an adjustment upward to reflect the quality and level of transit service passing through this lot. Given the activity level at the Prince William Parkway (Horner Road) lot it was recommended by the TAC stakeholders that additional demand be assigned there and that the resulting demand for spaces be met. The excess capacity associated with the park-and-ride lot at the I-95 and VA 123 interchange was excluded from the analysis because it has access issues and has historically been underutilized.

The forecasted Dumfries subarea demand can be addressed by the proposed expansion of the lot at U.S. 1 at VA 234. However, there is some question about the accuracy of the utilization of the current lot as it is believed that the count data did not account for all of the users. This lot is currently at capacity and there is some evidence that users may park at off-property locations in the adjacent areas. Under direction from VDOT staff and the TAC, the recommendation is for an additional 500 spaces for this lot. The U.S. 1 at VA 234 lot is a very successful park-and-ride facility and it is expected that the demand will grow for that lot.

The Potomac Mills and Springfield/Lorton areas have the lowest growth in demand among subareas. The Potomac Mills subarea shares demand with the Woodbridge subarea, but for this analysis they have been evaluated separately. The Potomac Mills subarea shows a need for 500 new spaces, and it is recommended to add these spaces to the PRTC Transit Center. This is the future location for the proposed in-line station and will further allow HOV and transit users to take advantage of the transit service through this hub. There is available capacity at other lots in the subarea, but given the location of the proposed in-line station, the transit center provides a convenient location for transit and ridesharing activities.

The Springfield/Lorton area shows a need for 450 spaces in the Springfield CBD. These spaces may have to be structured parking and have been evaluated at that cost for this analysis. There were three lots in this subarea with uncertainty about their availability in the future. The lots that may be closed are American Legion lot, K-Mart lot, and the Springfield Mall Macy's lot. The new lot just completed is the Backlick North lot with 261 spaces was added to the analysis. The other lots in the CBD area, excluding the Metrorail Station, are privately owned and Fairfax County has agreements/proffer for their use. For this analysis it was assumed that these spaces would be available in the future since they have been used for the past several years.

**Figure 7-6. Park-and-Ride Lots – 2030 Future Needs**



### 7.3.1 Fiscally Constrained Recommendation

The total spaces needed in the corridor to match the demand and provide the maximum utilization of 90 percent is approximately 9,700, including the WMATA identified need. Under the PPTA proposal, Fluor-Transurban is expected to build 3,000 spaces. The remaining need requires supplemental funding to address the projected demand. The Fiscally Constrained Alternative, presented in Section 9.0, recommends $37.5 million be made available for park-and-ride needs. The recommended allocation was developed, intended to balance multiple factors:

1. Provide parking for the proposed in-line stations;

2. Address areas with the largest difference between forecasted demand and forecasted capacity; and

3. Minimize partial funding of park and ride lots and thereby minimize disruption at the facilities (minimize partial builds on lots).

Table 7-4 shows the resulting recommended needs and the project priority funded spaces under the Refined Alternative and Fiscally-Constrained Refined Alternative.

## Table 7-4. Funded Versus Needed Parking Spaces by Subarea

| | Forecast Demand | | Parking Proposed | | | |
|---|---|---|---|---|---|---|
| **Subarea Districts** | **2015 (Spaces)** | **2030 (Spaces)** | **Refined Alternative (Spaces)** | **Fiscally-Constrained Refined Alternative (Spaces)** | **Non-Funded Needs (Spaces)** | **Percentage of Identified Need that is Funded (Spaces)** |
| Dumfries | 700 | 700 | 500[a] | 0 | 500 | 0% |
| Fredericksburg | 3,000 | 3,900 | 1,250 | 475 | 775 | 38% |
| Franconia-Springfield Metro Station | 5,800 | 6,300 | 1,925[a] | 0 | 1,925 | 0% |
| North Stafford | 2,800 | 3,800 | 2,125 | 2,125 | 0 | 100% |
| Potomac Mills | 1,700 | 1,900 | 500 | 250 | 250 | 50% |
| Springfield/Lorton | 1,900 | 2,100 | 450 | 450 | 0 | 100% |
| VRE | 4,900 | 4,900 | 1,500 | 1,500 | 0 | 100% |
| Woodbridge | 3,900 | 4,200 | 1,450 | 1,200 | 250 | 83% |
| **Total Demand** | **24,700** | **27,800** | **9,700** | **6,000** | **3,700** | **62%** |

[a] Designates additional need that was identified by the TAC beyond rather that shown through the analytical tool.

Overall, the total spaces recommended by the Fiscally Constrained Alternative and proposed for Fluor-Transurban represent 62 percent of the identified need. This figure includes WMATA's stated parking need at the Franconia-Springfield Metrorail Station. Excluding WMATA-stated needs, the total spaces recommended represents 77 percent of the identified need (which includes 90 percent utilization of the supplied spaces as a target). Therefore, much of the subareas' needs are being met under this allocation.

Given that demand for parking at the Franconia-Springfield Metro Station appears to exceed its available supply and given that the sector plan has proposed redevelopment and densification, there could be need for additional spaces in the Springfield Subarea beyond those forecast with our methodology and assumptions. An additional level of analysis would be necessary to evaluate to what extent station parking demand could be satisfied by additional satellite parking in the Springfield subarea. Without such an analysis, it can only be speculated that some percentage of the on-site demand could be satisfied with off-site spaces.

Accepting that additional spaces may be required in the Springfield Subarea, any additional funded spaces allocated to it would have to come at the expense of funding for spaces in other subareas. Given the land use in the Springfield Subarea, the spaces being allocated are assumed, for this analysis, to be structured parking and cost more to construct than surface spaces. Therefore, for every space added to the Springfield Subarea, approximately three surface spaces would need to be taken away elsewhere in the corridor.

The allocation of spaces recommended in the Fiscally-Constrained Refined Alternative in Table 7-4 appears to balance needs in the corridor, particularly when thought is given to the location of the proposed VRE parking enhancements. For example, the Fredericksburg subarea benefits indirectly from the VRE parking allocation in that area. The need ascribed to the Dumfries subarea was not developed through the demand analysis and has therefore was discounted in our prioritization, particularly in light of an already planned 500-space expansion for the area.

As is noted in the Investment Strategy section, the recommendations about parking sizing and location are subject to change based on more rigorous follow-up analysis focused on site opportunities and constraints. For the Woodbridge, Potomac Mills, and Dumfries subareas it is acknowledged that there is some overlap in the markets served among these areas. Due to this overlap, it is noted that refined information may, in the end, warrant allocation among the three sub-areas differently.

The spaces have been further allocated to designate those spaces to be addressed by the Fluor/Transurban pledge and those spaces to be addressed using the additional funding from the fiscally-constrained recommendation. It is recommended that the Fluor/Transurban pledge be used to construct the following:

- 450 spaces in the Springfield/Lorton subarea;
- 300 spaces for the Massaponax transit center in the Fredericksburg subarea;
- 1,050 of the 1,500 spaces at the proposed VA 610 at U.S. 1 lot (North Stafford subarea); and
- 1,200 additional spaces at the Prince William Parkway (Horner Road) lot (Woodbridge subarea).

The $37.5 million allocated for park-and-ride spaces as part of the transit/TDM strategies should be used to build the following spaces:

- 175 spaces for the Fredericksburg subarea;
- The remaining 1,075 spaces recommend for the North Stafford subarea (includes remaining spaces at VA 610 and spaces at VA 630);
- 250 spaces for the Potomac Mills subarea at the PRTC transit center; and
- 1,500 spaces at the VRE stations.

There are additional needs that cannot be addressed under the Fiscally Constrained Refined Alternative. If funds are obtainable, then addressing these needs should be considered. Additional spaces recommended, but unfunded, are:

- 500 spaces for the Dumfries subarea;
- 775 spaces for the Fredericksburg subarea;
- 1,925 spaces for Springfield Metrorail Station;
- 250 spaces for the PRTC transit center in the Potomac Mills subarea; and
- 250 spaces at the Prince William Parkway (Horner Road) lot.

## *7.4 Additional Analysis Needed*

The park-and-ride analysis presented in this section represents a planning document rather than the actual programming of spaces and lots. Further study is needed to detail certain elements of the park-and-ride plan, including:

- Details on the specific location and available land resources;
- The park-and-ride recommendations will require preliminary engineering work to be done in order to provide implementation cost estimates and to identify environmental or other concerns; and
- Further study may be desired of park-and-ride needs as well as other transit and mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOV/HOT-Lane Project.

# 8.0 Cost Estimates

The TAC provided important input in developing the cost estimates for the Refined Alternative. Cost data was obtained through the Federal Transit Administration (FTA) National Transit Database (NTD), through a survey of the local operators, and through individual discussions. The objective was to incorporate local costs. This section outlines important assumptions and data used to develop the estimates and presents the summary estimate.

## *8.1 Assumptions*

Assumptions are divided into overall, operating, and capital cost categories and discussed in the following subsections.

### 8.1.1 Overall Costs

The concept of Present Value guided the development of the cost estimates. That is, costs were stated in terms of a single reference year. The reference year was developed as 2010. For existing costs this meant inflating to 2010 for use as the base year. Based on consumer price index (CPI) data, a three percent annual increase was employed. A 20-year horizon was used for accumulating costs.

### 8.1.2 Operating Costs

The following operating cost assumptions were applied:

- For the Refined Alternative it was assumed that all services would be operated for the entire 20 years. For the fiscally constrained alternative (described in Section 9.0, Investment Strategy) a phasing plan was developed where some services would operate for shorter time periods.

- A straight cost per hour model (rather than a multiple variable cost model) was used. The level of accuracy is sufficient with this method given that 20-year cost estimates are being developed.

- Incremental/marginal costs were used for public transit operators. Thus, the cost estimates include operating costs, maintenance, and insurance/accidents (but not other administrative costs). To ensure “apples” to “apples” comparisons, the most recent NTD data reports for each system were used. The relevant NTD costs are increased for inflation to bring them to 2010 dollars.

- Cost per ***vehicle*** hour was used. Vehicle hours were used rather than revenue hours since this includes deadhead hours in the estimates. Adjusted to year 2010 dollars, the following incremental cost per vehicle hour figures apply:

  - WMATA = $95.24;
  - Fairfax Connector = $93.82;
  - PRTC = $86.77;
  - FAMPO express routes = $86.77
  - FRED = $53.05;

  - ART = $82.67;
  - DASH = $64.76;
  - Additional costs associated with longer VRE trains represents $300,000/train annually; and
  - To add three additional trains, VRE estimates the operating cost to be $1.4 million per round trip annually (includes railroad access fees).

- Assumed deadhead of 10 percent for services that are not commuter/one-way based on 2006 NTD data on vehicle hours/revenue hours. For commuter services, it was assumed that they deadheaded back to PRTC or Stafford/Fredericksburg.

### 8.1.3 Capital Costs

The following capital cost assumptions were applied:

- Vehicles – for the refined alternative, the cost of purchases required during the 20 year period was assumed. For the fiscally constrained alternative, the phasing plan for each service was used to determine the cost of purchases during the applicable period. The following schedule of costs was used for purchased equipment in 2010 dollars:
  - Bus – 12-year life – 40-foot Low Floor $500,000;
  - Bus – 12-year life – 30-foot Low Floor $325,000;
  - Commuter Rail Cars – $2.1 million; and
  - Commuter Rail Locomotives – $4 million.
- In-Line Stations – $10 million per station – not including parking. Parking at in-line stations was budgeted separately using the parking space allotment (below).[1]
- Parking – $10,000 per surface space for VDOT (VRE uses $15,000 per surface space construction cost and $30,000 per structured space construction cost).
- Other station improvement estimates come from operators (VRE platform extensions, Metrorail transit center improvements).
  - Metrorail bus transit center improvements – rough estimate of $2.5 million per transit center;
  - Massaponax transit center – $1.5 million;
  - VRE platform extensions – $1 million for 300-foot extension; and
  - VRE Crossroads yard extension *(end of Fredericksburg line)* – $1.35 million

## *8.2 Detailed Estimate*

Total capital costs for the Refined Alternative, unconstrained by revenue limitations, were estimated at $230 million in year 2010 dollars. Cumulative operating and maintenance costs in 2010 year dollars were estimated at $417 million. The total 20-year program cost for the Refined

[1] The unit cost figure is intended as a planning estimate inclusive of reasonable project-induced elements except parking and transit service provisions. The planning figure for parking facilities similarly is a planning estimate with some embedded allowances for access costs. The conceptual engineering phase of project planning will provide more robust cost estimates.

Alternative in year 2010 dollars is therefore $647 million. In year-of-expenditure dollars, these figures are approximately $595 million for cumulative operating and maintenance costs, $267 million for capital costs, and $862 million in total. Exhibit 8-1 presents a summary of the cost estimates and assumptions for each project element in the Refined Alternative.

# Exhibit 8-1

| Service Modifications | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Vehicle Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Cost | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | 20-Year Capital Cost | 20-Year Total Costs (2010 Dollars) |
| Arlington/ Alexandria/DC | ART | **ART 41** -Add 5th bus to ART 41 on weekdays | 3,640 | 4,004 | $82.67 | $331,011 | $6,620,214 | 1 | $325,000 | 12 yr - 30' Low Floor - $325K | $650,000 | $7,270,214 |
| Arlington/ Alexandria/DC | WMATA | **WMATA 7B -** Decrease headway on 7B from 35 minute to 17/18 minute by adding one bus | 1,560 | 1,716 | $95.24 | $163,432 | $3,268,637 | 1 | $500,000 | 12 yr - 40' - $500K | $1,000,000 | $4,268,637 |
| Prince William | PRTC | **Dale City - Navy Yard -** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds 2 additional trips per peak period | 1,820 | 3,640 | $86.77 | $315,843 | $6,316,856 | 1 | $500,000 | 12 yr - 40' - $500K | $1,000,000 | $7,316,856 |
| Prince William | PRTC | **OmniRide North Route 1 (Dale City/Woodbridge - DC)** - Increase Frequency on OmniRide North Route 1 by adding 3 additional trips in each peak period, one in midday and late evening | 3,467 | 6,933 | $86.77 | $601,605 | $12,032,107 | 3 | $1,500,000 | 12 yr - 40' - $500K | $3,000,000 | $15,032,107 |
| Prince William | PRTC | **OmniLink Route 1** - Extend OmniLink Route 1 to Ft. Belvoir during peak periods | 2,080 | 2,288 | $86.77 | $198,530 | $3,970,595 | 1 | $325,000 | 12 yr - 30' Low Floor - $325K | $650,000 | $4,620,595 |
| Prince William | PRTC | **Prince William MetroDirect** - Modify MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours | 1,040 | 1,144 | $86.77 | $99,265 | $1,985,298 | 1 | $500,000 | 12 yr - 40' - $500K | $1,000,000 | $2,985,298 |
| Corridor-wide | VRE | **VRE Train Size** - Increase train size so that 3 of the Fredericksburg trains have 8 cars and 4 have six cars | | | VRE estimated add'l cost associated with longer trains - 2 add'l 8 car trains @ $300,000/year | $600,000 | $12,000,000 | 6 | $12,600,000 | $2.1M/car | $12,600,000 | $24,600,000 |
| | | **TOTAL** | **13,607** | **19,725** | | **$2,309,685** | **$46,193,706** | **14** | **$16,250,000** | | **$19,900,000** | **$66,093,706** |

| New Shuttle/Feeder Bus Services | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Revenue Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Cost | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | 20-Year Capital Cost | 20-Year Total Costs (2010 Dollars) |
| Alexandria | Alexandria - DASH | **Seminary Road Shuttle -** New shuttle from Seminary Road In-line stations to jobs at Mark Center and Skyline | 1,560 | 1,716 | $64.76 | $111,128 | $2,222,563 | 1 | $325,000 | 12 yr - 30' Low Floor - $325K | $650,000 | $2,872,563 |
| Fairfax/ Springfield | Fairfax Connector | **Franconia-Springfield Metro-EPG-Ft. Belvoir Shuttl**e - New shuttle service between the Springfield Metro - EPG - Ft. Belvoir via Franconia-Springfield Parkway and Fairfax County Parkway | 4,680 | 5,148 | $93.82 | $482,985 | $9,659,707 | 3 | $1,500,000 | 12 yr - 40' - $500K | $3,000,000 | $12,659,707 |
| Fairfax/ Springfield | Fairfax Connector | **Lorton VRE-EPG -Ft. Belvoir Shuttl**e - New "meet the train" shuttle or subscription service between the Lorton VRE Station - EPG/Ft. Belvoir via Telegraph Rd, Fairfax County Parkway and Rolling Rd/Pohick Rd. | 2,600 | 2,860 | $93.82 | $268,325 | $5,366,504 | 2 | $1,000,000 | 12 yr - 40' - $500K | $2,000,000 | $7,366,504 |
| | | **TOTAL** | **8,840** | **9,724** | | **$862,439** | **$17,248,774** | **6** | **$2,825,000** | | **$5,650,000** | **$22,898,774** |

| New Bus/Rail Services | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Revenue Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Cost | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | 20 yr Capital Cost | 20-Year Total Costs (2010 Dollars) |
| Arlington/ Alexandria/DC | ART | **Shirlington - Rossyln** - New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area) | 3,120 | 3,432 | $82.67 | $283,723 | $5,674,469 | 2 | $650,000 | 12 yr 30'- $325K | $1,300,000 | $6,974,469 |
| Fairfax/ Springfield | WMATA | **Lorton/Laurel Hill -EPG - Pentagon** - New express bus route from Lorton - EPG-Pentagon. | 4,680 | 9,360 | $95.24 | $891,446 | $17,828,928 | 6 | $3,000,000 | 12 yr - 40' - $500K | $6,000,000 | $23,828,928 |
| Prince William/Fairfax | PRTC | **Woodbridge - Lorton - Tysons Corner - Merrifield -** New peak period OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner and Merrifield. | 3,120 | 6,240 | $86.77 | $541,445 | $10,828,896 | 4 | $2,000,000 | 12 yr - 40' - $500K | $4,000,000 | $14,828,896 |
| Prince William | PRTC | **Dale City/Lake Ridge - EPG** - New OmniRide route from Dale City/Lake Ridge to EPG (BRAC EIS proposed 30 minute headway). | 1,560 | 3,120 | $86.77 | $270,722 | $5,414,448 | 2 | $1,000,000 | 12 yr - 40' - $500K | $2,000,000 | $7,414,448 |
| Prince William | PRTC | **Woodbridge - EPG** - New OmniRide route from Woodbridge to EPG (proposed 30 minute headway peak only). | 1,040 | 2,080 | $86.77 | $180,482 | $3,609,632 | 2 | $1,000,000 | 12 yr - 40' - $500K | $2,000,000 | $5,609,632 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - EPG/Ft. Belvoir** - New Express/BRT route from Fredericksburg to EPG and Ft. Belvoir (proposed as 30 minute headways peak hour service only) | 4,680 | 9,360 | $86.77 | $812,167 | $16,243,344 | 6 | $3,000,000 | 12 yr - 40' - $500K | $6,000,000 | $22,243,344 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - DC** - New Express/BRT route from Fredericksburg to DC core (when combined with Massaponax, services would operate alternating 15 min) | 6,240 | 12,480 | $86.77 | $1,082,890 | $21,657,792 | 6 | $3,000,000 | 12 yr - 40' - $500K | $6,000,000 | $27,657,792 |
| Stafford/ Fredericksburg | FAMPO | **Massaponax - DC** - New Express/BRT route from Massaponax to DC core (when combined with Fredericksburg, services would operate alternating 15 min) | 6,240 | 12,480 | $86.77 | $1,082,890 | $21,657,792 | 6 | $3,000,000 | 12 yr - 40' - $500K | $6,000,000 | $27,657,792 |
| Fairfax/ Springfield | WMATA | **Kingstowne - Shirlington - Pentagon** - New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria. | 18,200 | 20,020 | $95.24 | $1,906,705 | $38,134,096 | 5 | $2,500,000 | 12 yr - 40' - $500K | $5,000,000 | $43,134,096 |
| Prince William | PRTC | **Central Prince William - Downtown Alexandria -** New OmniRide Route along I-95 corridor serving East Eisenhower Valley and Downtown Alexandria west of Washington Street | 3,120 | 6,240 | $86.77 | $541,445 | $10,828,896 | 4 | $2,000,000 | 12 yr - 40' - $500K | $4,000,000 | $14,828,896 |
| Prince William | PRTC | **Central PW - Pentagon - DC -** New OmniRide Route to start near Hoadley Rd, run express down PW parkway to the HOV lanes then to Pentagon and DC | 3,120 | 6,240 | $86.77 | $541,445 | $10,828,896 | 4 | $2,000,000 | 12 yr - 40' - $500K | $4,000,000 | $14,828,896 |

| New Bus/Rail Services | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Revenue Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Cost | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | 20-Year Capital Cost | 20-Year Total Costs (2010 Dollars) |
| Prince William | PRTC | **Dale City - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road | 2,080 | 4,160 | $86.77 | $360,963 | $7,219,264 | 3 | $1,500,000 | 12 yr - 40' - $500K | $3,000,000 | $10,219,264 |
| Prince William | PRTC | **Lake Ridge - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road | 2,080 | 4,160 | $86.77 | $360,963 | $7,219,264 | 3 | $1,500,000 | 12 yr - 40' - $500K | $3,000,000 | $10,219,264 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - Tysons Corner - Merrifield** - Extension of new Woodbridge - Lorton - Tysons Corner -Merrifield route to serve Fredericksburg area | 3,120 | 6,240 | $86.77 | $541,445 | $10,828,896 | 2 | $1,000,000 | 12 yr - 40' - $500K | $2,000,000 | $12,828,896 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - Pentagon/Crystal City** - New Express/BRT route from Fredericksburg to Pentagon/Crystal City (proposed as 30 minute headways peak hour only) | 6,240 | 12,480 | $86.77 | $1,082,890 | $21,657,792 | 6 | $3,000,000 | 12 yr - 40' - $500K | $6,000,000 | $27,657,792 |
| Corridor-wide | VRE/Amtrak | Increase number of VRE trains on the Fredericksburg Line from 14 to 20 per day (10 North/10 South). Assume mix of 6 and 8 car trains. | 2,340 | 2,574 | This would have three additional trains - VRE estimates the operating cost for those trains of $1.4M per round trip annually | $4,200,000 | $84,000,000 | 7 add'l cars above the "low" plus 3 add'l locomotives | $26,700,000 | $2.1M/car -and $4M/ locomotive | $26,700,000 | $110,700,000 |
| | | **TOTAL** | **70,980** | **120,666** | | **$14,681,620** | **$293,632,405** | **68** | **$56,850,000** | | **$87,000,000** | **$380,632,405** |

| Fixed Facilities | | | Capital Costs (2010 Dollars) | | | Total |
|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Capital Need | Potential Capital Costs | Capital Assumptions | 20-Year Total Costs (2010 Dollars) |
| Arlington/ Alexandria/DC | WMATA | **Pentagon Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security) | Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements | $2,500,000 | $2.5M per station | $2,500,000 |
| Fairfax/ Springfield | Fairfax Connector | **Franconia-Springfield Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security) | Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements | $2,500,000 | $2.5M per station | $2,500,000 |
| Fairfax/ Springfield | Fairfax Connector | **Transit Center** near Ft. Belvoir/EPG | | $10,000,000 | $10M per center | $10,000,000 |
| Fredericksburg | FAMPO | **Transit Center** at Massaponax | | $1,500,000 | $1.5M per center | $1,500,000 |
| Corridor-wide | | **Additional park-and-ride lot capacity** at various locations (new and/or existing lots): 500 spaces for Dumfries subarea; 1,250 spaces for the Fredericksburg subarea; 2,125 spaces for the North Stafford subarea; 500 spaces for the Potomac Mills subarea; 450 spaces for Springfield/Lorton subarea; 1,500 spaces for VRE stations; 500 spaces for the Woodbridge subarea. | Allowance for additional spaces beyond those currently proposed by Fluor/Transurban at specific locations to be determined | | $10,000 per VDOT space; $15,000 per VRE space | $54,000,000 |
| Corridor-wide | | **BRT in-line transit stations** considered along the corridor - 5 stations but 4 in-line stations included in cost | | $40,000,000 | $10M per station (not including parking) | $40,000,000 |
| Corridor-wide | ITS Improve-ments | **IT projects** to improve integration of information on HOT lanes/parking lots/bus/rail - NEXT Bus | | | | $2,000,000 |
| Corridor-wide | VRE | **Overnight Storage in Fredericksburg** | | $1,350,000 | | $1,350,000 |
| Corridor-wide | VRE | **Platform Extensions** at selected stations | Four stations on Fredericksburg Line would need platform extensions for "low" or "medium" alternatives | $4,000,000 | $1M to extend 300' including canopy | $4,000,000 |
| | | | | | **TOTAL** | **$117,850,000** |

| TDM Program Elements | | | Total |
|---|---|---|---|
| Originating Area Operator | Description | | 20-Year Total Costs (2010 Dollars) |
| Corridor-wide | **Capital Assistance For Vanpools -** Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital cost of Contracting for vanpools. Provide free electronic toll transponders to vanpools. | | $10,035,000 |
| Corridor-wide | **Carpool Incentives -** Rewards and incentives for carpoolers. | | $3,000,000 |
| Corridor-wide | **Enhanced Guaranteed Ride Home -** Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday. | | $2,500,000 |
| Corridor-wide | **HOVER Pilot Program -** HOVER is a facilitated 'park and ride-share' system that involves tracking of all participants usage, and sharing of costs and benefits through a combination of financial and 'HOVER Ride Credit' accounts. Members earn credits for picking up passengers and passengers use their credits to ride. Ride credits are tracked electronically. A park-and-ride lot with 150 - 200 spaces is needed | | $3,000,000 |
| Corridor-wide | **Rideshare Program Operational Support -** Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit. | | $15,000,000 |
| Corridor-wide | **TDM Programs Marketing -** Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. Provide new signage to promote TDM programs. | | $10,550,000 |
| Corridor-wide | **Telework Program Assistance -** Financial incentives and assistance to increase the number of workers teleworking. | | $9,500,000 |
| Corridor-wide | **Vanpool Tracking for NuRide -** Develop a tracking mechanism (GPS, cell phone) to track vans used for vanpools and vanpool riders for NuRide. | | $200,000 |
| Corridor-wide | **Vanpool Driver Incentives -** Provide incentives to get new drivers and retain existing drivers for vanpools. | | $750,000 |
| Corridor-wide | **Vanpool Insurance -** Increase vanpool insurance premium pool buy-down for vanpools. | | $4,000,000 |
| Corridor-wide | **VanStart/VanSave -** Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats. | | $1,300,000 |
| | | **TOTAL** | **$59,835,000** |

| | Operating | Capital | TOTAL |
|---|---|---|---|
| **Total** | **$416,909,885** | **$230,400,000** | **$647,309,885** |

# 9.0 Investment Strategy

## *9.1 Purpose of the Investment Strategy*

This section details the Fiscally Constrained Alternative which includes transit/TDM services and park-and-ride improvements for the corridor. Funding is not currently available for all of the services and programs detailed in the Refined Alternative and Park-and-Ride Analysis. The purpose of this investment strategy is to prioritize and phase recommendations from the Refined Alternative and Park-and-Ride Analysis with estimates of reasonably available revenues and develop a phased transit/TDM project proposal for the corridor. The improvements and investment strategy outlined below would also substitute for the I-95/I-395 HOT lane transit improvements approved in the 2007 MWCOG CLRP and potentially guide the development of the FAMPO CLRP. Costs and revenues within this section are expressed in year 2010 dollars unless otherwise noted.

## *9.2 Objectives of the Investment Strategy*

The proposed I-95/I-395 transit improvements and investment strategy are intended to serve the following objectives:

1. Protect and respect currently planned and programmed transit improvements and associated funding sources;
2. Identify all reasonably available funding sources for the proposed improvements;
3. Prioritize and phase the proposed improvements to satisfy multiple objectives that serve to implement the "best" improvements first; and
4. Leverage reasonably available funding to maximize resources available for the proposed improvements.

## *9.3 Reasonably Available Revenues for I-95/I-395 Transit/TDM Improvements*

The region as a whole, as well as local jurisdictions in the study area, have both a short- and long-term stake in the effort to enhance transit and TDM services in parallel with the proposed implementation of HOT lanes in the I-95/I-395 corridor. In the short-term, enhanced transit/TDM services will serve trips originating along the corridor but with destinations throughout the region, including the Washington downtown core. In the long-term, enhanced transit services in the corridor are likely to become a key part of an expanded regionwide network of high-capacity services operating in major corridors that are already experiencing high levels of congestion.

Historically, regional transportation needs have out-stripped the combined resources available from the Federal, state, and local levels. This remains true today despite recent and continuing major commitments of Federal funds to projects and services of vital importance, e.g., the Woodrow Wilson Bridge and the Springfield Interchange. Looking ahead to the implementation of additional transit improvements in the I-95/I-395 corridor as part of HOT lane project, there continue to be constraints on reasonably available revenues, as noted below, such that the entire program of proposed improvements cannot be completed without additional funding. As a result, prioritization and phasing of proposed improvements is required and an approach to doing so is defined as part of the investment strategy.

In addition to revenue constraints, the intergovernmental complexity of the region poses a challenge. Varied philosophies of governance, unique budgeting and negotiated fund allocation arrangements among local jurisdictions and the State, and the presence of multiple transit operating agencies serving varied portions of the study area contribute to the complexity of funding and instituting new transit services in the I-95/I-395 corridor.

With these contextual challenges noted, the estimate of reasonable available revenues for the I-95/I-395 transit improvements is provided below.

### 9.3.1 HOT Lane Project Funding Contribution: $195 Million

Project sponsors have proposed that the project will provide a ***lump sum payment of $195 million*** to support additional transit capital and operating improvements beyond those already specified in the original I-95/I-395 HOT Lane proposal (e.g., extension and expansion of the HOV facility, construction of the Lorton in-line station related facilities, and three thousand parking spaces). It is anticipated that these funds would be ***available at the time that the Fluor-TransUrban-VDOT Master Agreement for the HOT lanes project is signed,*** currently projected to be in late calendar 2008. Availability of these funds at that time will allow for priority investments to be undertaken expeditiously, particularly those that may require synchronization with implementation of the northern segment of the HOT lanes.

### 9.3.2 Additional Farebox Revenues: $63 Million

As new transit services are brought on line, ***additional farebox revenues*** will be available over time to support a portion of the operating cost of the added services. The farebox recovery ratio appropriate for each operator and/or type of services was assumed, based on local data reported in the National Transit Database (NTD). PRTC provided further information on the difference in farebox recovery for their local versus commuter services. Farebox cost recovery among systems and services operating in the study area ranges from a low of 20 percent to a high of 50 percent:

- Local Services:
  - **WMATA –** 30 percent;
  - **PRTC –** 38 percent
  - **Alexandria – DASH** – 26 percent;
  - **Fairfax Connector –** 20 percent;
  - **ART –** 25 percent; and
  - **VRE –** 47 percent.
- Commuter Service – 50 percent.

Based on a weighted average, farebox recovery is approximately 37 percent among relevant providers. That means that for every $1 in operating cost incurred by new services, an average of 37 cents will be contributed by riders and another 63 cents will have to be provided from the HOT lane project contribution or other sources to cover operating costs. Subsidy levels have been estimated for planning purposes. The actual performance of specific services will not become known until after services (and capital investments) have been implemented.

### 9.3.3 Federal Funding: $40 Million

The current Federal authorization for transit and highway programs (SAFETEA-LU) ends with the 2009 fiscal year. For the purpose of I-95/I-395 transit improvements, it is assumed that ***limited additional Federal funding, formula, or discretionary,*** will be made available from traditional programs to the region for I-95/I-395 transit improvements through this period. The FTA designated recipients in the Washington D.C. urbanized area determine how Federal transit funds are spent in that urbanized area, which encompasses northern Stafford County. For example, a portion of FTA funding to the region from Sections 5307 (Urban Formula), is currently suballocated by WMATA to VRE and PRTC on a formula basis by standing agreement. Essentially, local and regional programming and priorities already dictate the use of funds to the region from presumed 2008 and 2009 Federal appropriations. Therefore, funds from these programs are not anticipated to be reassigned or reallocated for use in the I-95/I-395 corridor.

***The exception in the short term is the U.S. DOT Congestion Initiative/Congestion-Reduction Demonstration Initiatives program,*** for which a proposal solicitation was issued in the *Federal Register* on November 13, 2007. It is the purpose of the program to support efforts that "integrate innovative transit strategies, new transportation technologies, and direct highway pricing during congested periods."[1]

Funding for the approved projects under the Congestion initiative is intended to be provided by a combination of U.S. DOT highway and transit programs at the discretion of the U.S. DOT and modal administrations. This Investment Strategy assumes that VDOT/DRPT intends to apply and will be successful in gaining an additional $40 million to support I-95/I-395 transit capital improvements in concert with the HOT lane project from this initiative or other present or future FTA programs.[2]

#### *Out-Year Federal Funding*

Reauthorization of current Federal transit and highway programs is expected over the next two years. This action will determine the scope and focus of Federal transit programs and the level of Federal transit investments for what is expected to be a six-year authorization period. Both in the immediate upcoming reauthorization and certainly in subsequent reauthorizations, several factors mitigate against presuming additional (or continuing) Federal funding for I-95/I-395 transit improvements through subsequent reauthorizations:

- It is impossible to forecast the size, scope, and nature of Federal programs or actual legislative timetables for their enactment;
- The region already has successfully claimed enormous amounts of *discretionary* Federal funding for the major projects noted earlier, some of which remain ongoing and/or are yet to begin;
- Federal *formula* transit funds apportioned to FTA designated recipients in the region are critical to continue these services throughout the region. Availability of formula funds for transit improvements in the corridor will depend largely on how closely they may match FTA designated recipient priorities. Any reallocation of formula funding away from those priorities would necessitate increases in local jurisdictions' support, an unlikely and undesirable consequence, politically, and financially.

[1] Federal Register, Volume 72, Number 218, November 13, 2007, pp. 63951-63956.

[2] The Omnibus Appropriations Bill enacted by Congress in late December 2007 severely limits the Administration's latitude to divert Federal bus discretionary funding for 2008.

Should FAMPO be apportioned formula funds from FTA in the future, it is possible that FAMPO priorities might result in corridor improvements receiving some additional support from FTA formula funding;

- The gap between regional transportation needs, priority investments, and reasonably anticipated Federal funds is such that no other Federal programs, highway, transit, or flexible funds are likely sources for additional transit investment in the I-95/I-395 corridor; and

- Programming and priority-setting for transit and transportation investment in the region are, to a considerable extent, "bottoms-up" processes with local jurisdictions exercising considerable authority in prioritizing investments. It is unlikely that short- or long-term local priorities and associated funding flows will be altered to accommodate any of the I-95/I-395 transit investment, except in cases where proposed corridor investments directly match local priorities.

### 9.3.4 State Funding: None

***Transit Operations.*** Enactment of HB 3202 allows for an increase in the ratio of state assistance for transit operations. With increasing demand and costs, however, it is unlikely that additional state funding for transit operations will be forthcoming generally or explicitly for transit improvements in the I-95/I-395 corridor.

***Transit Capital.*** HB 3202 includes $300 million in new state bonding authority for transportation capital investment, statewide. Of that, $60 million is explicitly available for transit, including new services. Corridor projects must compete statewide for these funds. It is impossible to estimate, therefore, what portion of these funds might ultimately come to Northern Virginia, or if available in the region, if any would be directed to the proposed I-95/I-395 transit improvements as a reflection of local priorities.

Given current discussions about the potential vulnerability of the provisions of HB 3202 in the Virginia legislature, it is assumed that ***no additional state funding will become available to I-95-395 transit improvements.***

### 9.3.5 Regional Funding: None

Enactment of HB 3202 provided Northern Virginia, through member jurisdictions of NVTA, the authority to raise new revenues for transportation from five tax sources, approval for which has been achieved by the jurisdictions. The yield from all five "self-help" sources is estimated to be approximately $290 million annually. Revenue collection is to begin January 1, 2008, assuming resolution of pending legislative discussion in favor of the continued implementation of HB 3202 as it was enacted. Funding priorities and programming for the first two years of revenues from these sources already has been determined. A six-year program of priority investments is expected to follow. Given the gap between needs and resources, and the nature of priorities among local jurisdictions, it is ***unlikely that funding from these sources will flow to the proposed I-95/I-395 transit improvements.***

### 9.3.6 Local Funding: None

HB 3202 provided authority for enactment of three new local option taxes to support priority transportation investments, presumably on a local scale. The Investment Strategy presumes that the proposed I-95/I-395 transit improvements will rarely, if ever, displace the priorities of local jurisdictions, should they choose to enact local option taxes.

### 9.3.7 Reasonably Available Revenue Summary

For the purpose of supporting presentation and adoption of a new CLRP proposal on transit improvements in the I-95/I-395 corridor, reasonably available revenues are estimated to include:

| | |
|---|---|
| **HOT Lane Project Contributions** | **$195 million** |
| **Transit Farebox Revenues** | **63 million** |
| **Federal Discretionary Funds** | **40 million** |
| | **$298 million** |

## *9.4 Funding Flows*

Funding flows, cash management, and risk management are important elements of the investment strategy. From the discussion above, several key assumptions and implications can be drawn.

### Assumption 1

Receipt of a cash payment as a lump sum ($195 million) from the HOT lanes sponsor.

### Implication

a. I-95/I-395 transit investments will be made on a "pay-go" basis since no regular flow of funds is anticipated to bond against, except possibly the added increment of farebox revenues, which will likely be insufficient to reasonably support debt on their own.

b. The lump sum should be invested to maximize interest earnings within the normal accepted level of risk for local governments. The interest rate earnings must be at least equal to the inflation rate applied in the year of expenditure calculations (i.e., three percent).

### Assumption 2

For projects and improvements that best compete for Federal funds, the necessary match will come from reasonably available funds, as highlighted above, on a priority basis.

### Implication

a. Successful application for additional discretionary Federal funds will create a separate subprogram of investments and improvements potentially outside the expressed priorities of local and regional agencies.

b. After satisfying match requirements should additional Federal discretionary funds be granted, remaining reasonably available revenues will be expected to support 100 percent of successive I-95/I-395 transit improvement costs in combination with farebox revenues for all operating agencies whose improvements are implemented.

### Assumption 3

Reasonably available funds, as highlighted above, would be fully committed to an initial program of corridor transit improvements in the period 2010 to 2020 to maximize the impact of available funds and to provide a service base and performance that has the best chance of attracting future funding to support continued implementation of the full program.

## *9.5 Prioritization and Phasing*

### 9.5.1 Phasing

Regardless of the amount of funding that is projected to be reasonably available to implement the improvements in the Refined Alternative, actual implementation will have to be phased, with priorities established for which improvements are to proceed first. Moreover, given that the funding required to implement all elements of the Refined Alternative is not available, some elements must be set aside.

The regional modeling and analytical processes used in the project are not capable of supporting detailed cost-benefit, Return on Investment (ROI), or similar econometric analysis of individual or route-specific improvements proposed. Analysis at this level will need to be considered, however, for subsequent programming purposes.

For planning purposes, however, conclusions can be drawn as to the relative performance of proposed improvements in the interest of identifying a general package or subset of improvements that should go forward using the $298 million in funding considered reasonably available.

The criteria for making these judgments in order of importance include:

- ***Productivity –*** How much travel demand is being accommodated or how much of the new capacity is being used and at what cost for each of the prospective improvements, i.e., investment in the "best" services first from a utilization and cost-effectiveness standpoint. Specifically, attention was given to trips per revenue hour, cost per trip, and subsidy per trip.

- ***Rapid impact –*** How quickly forecast utilization of service improvements can be realized to maximize impact on travel markets and to reduce subsidy costs, i.e., investment in the best performing improvements in the existing services.

- ***Ease of Implementation –*** How quickly and easily service improvements can be introduced in view of existing priorities and required operational and budgeting processes or procedures?

- ***Leveraging –*** Commitments of funds early to specific service improvements could lead to contributions from funding sources not otherwise likely to be available, e.g., DOD funding for some portion of BRAC-related services.

- ***Long-Term Regional Network Effects –*** Which projects or improvements have the greatest potential to enhance the future regional network, or may undercut long-term network plans if not pursued in the short-term, e.g., HOT lane or BRT networks?

Given the elements in the Refined Alternative, the following program-specific prioritization principles were applied to constrain and phase the program:

- Start with funding of $235 million net of farebox recovery;
- Fund significant level of TDM and additional park-and-ride spaces, but reduce the amount of funding assumed from Refined Alternative levels;
- Invest in fixed facility improvements (e.g., in-line BRT stations, transit centers) that could support new transit improvements and could also stand alone based on the higher level of service already planned in the CLRP;
- Increase number of VRE rail cars in 2015;
- Improve bus services by phasing in services by year with the most productive services earlier in the program. Start with the expansion of existing services, a strategy supported by the market research element of study. Include BRAC-related services that are most productive;
- Set aside routes in the Refined Alternative if reasonably comparable service is included in the CLRP; and
- No fare buy-down since it appears to mostly shift people out of HOV, rather than making a large impact on current LOV users.

### 9.5.2 Cost Summary

The resulting Fiscally Constrained Refined Alternative can be summarized in year 2010 expenditures in Table 9-1.

## Table 9-1. Program Summary of the Fiscally Constrained Recommendation

| Element | Element Cost (Millions) | Total Cost (Millions) |
|---|---|---|
| *Transit Services* | | *$188.9* |
| Bus Service Modifications | $29.6 | |
| New Shuttle Bus | $7.4 | |
| New Bus Services | $130.3 | |
| VRE | $21.6 | |
| *TDM* | | *$20.0* |
| | | |
| *Park-and-Ride Lots* | | *$37.5* |
| | | |
| *Fixed Facilities* | | *$51.8* |
| Metrorail Station Improvements | $5.0 | |
| BRT Stations | $40.0 | |
| Other Transit Centers | $1.5 | |
| VRE Platform Extensions and Yard Facilities (with Longer Trains) | $5.3 | |
| **Grand Total** | | **$298.2** |

## *9.6 Recommended Investment Program*

Exhibit 9-1 details the program elements and implementation timetable for the Cost-Constrained Refined Alternative in year 2010 dollars and year-of-expenditure dollars. The year-of-expenditure calculations assume a three percent inflation rate.

## *9.7 Additional Analysis Needed*

The Investment Strategy proposed in this section represents a planning document rather than the actual programming of projects. Further study is needed to detail certain elements of the Investment Strategy plan, including:

- Details on the specific location and function of the proposed BRT in-line stations is needed to better explain the issues and opportunities associated with them and to identify any potential fatal flaws which may exist;

- Detailed traffic simulation needs to be performed to determine the potential for adverse impacts to traffic from increased bus operations at selected locations. Specifically, the City of Alexandria has expressed its concern/objection to the proposed facility access ramp at Seminary Road. The impact of this ramp and alternative locations in the northern section of the corridor need to be explored;

- Design standards need to be established for the in-line stations and the park-and-ride lots. The BRT stations and park-and-ride recommendations will require preliminary engineering work to be done in order to provide implementation cost estimates and to identify environmental or other concerns.

- Further study may be required for transit and other mobility enhancement projects in the corridor beyond the constraints imposed by the availability of funds from the I-95/I-395 HOV/HOT Lane Project. For example, further study of the extension of VRE south of Fredericksburg or the extension of Metrorail toward Potomac Mills Mall may be desirable.

- The Fiscally Constrained Refined Alternative serves as the basis for submitting a revision to the transit and TDM elements of the MWCOG CLRP project for the I-95/I-395 HOT Lane Project. The submission can include all of the indicated project elements except the southern-most in-line BRT station to maintain compatibility with the limits of the HOT Lane Project.

# Exhibit 9-1

| Service Modifications | | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Summary Costs (2010 Dollars) | | | Summary Costs (Year of Expenditure) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Imple-menta-tion Year | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Vehicle Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Costs | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | Capital Cost | Total Costs (2010 Dollars) | Projected Farebox Revenue (2010 Dollars) | Net Total Costs (2010 Dollars) | Total Costs | Projected Farebox Revenue | Net Total Costs |
| Arlington/ Alexandria/DC | ART | **ART 41** -Add 5th bus to ART 41 on weekdays | 2010 | 3,640 | 4,004 | $82.67 | $331,011 | $6,620,214 | 1 | $325,000 | 12 yr - 30' Low Floor - $325K | $650,000 | $7,270,214 | $1,655,053 | $5,615,160 | $10,280,595 | $2,373,056 | $7,907,540 |
| Arlington/ Alexandria/DC | WMATA | **WMATA 7B -** Decrease headway on 7B from 35 minute to 17/18 minute by adding one bus | 2010 | 1,560 | 1,716 | $95.24 | $163,432 | $3,268,637 | 1 | $500,000 | 12 yr 40' - $500K | $1,000,000 | $4,268,637 | $980,591 | $3,288,046 | $5,899,531 | $1,405,995 | $4,493,536 |
| Prince William | PRTC | **Prince William MetroDirect** - Modify MetroDirect Route to provide limited circulation in the Springfield area after serving the Franconia-Springfield station during peak hours | 2015 | 1,040 | 1,144 | $86.77 | $99,265 | $1,488,973 | 1 | $500,000 | 12 yr 40' - $500K | $1,000,000 | $2,488,973 | $744,487 | $1,744,487 | $3,725,618 | $1,159,779 | $2,565,839 |
| Prince William | PRTC | **Dale City - Navy Yard -** Improvements to existing Dale City-Navy Yard route to serve additional park-and-ride lots along I-95 corridor and increase frequency. Adds 2 additional trips per peak period | 2015 | 1,820 | 3,640 | $86.77 | $315,843 | $4,737,642 | 1 | $500,000 | 12 yr 40' - $500K | $1,000,000 | $5,737,642 | $2,368,821 | $3,368,821 | $8,786,470 | $3,690,205 | $5,096,265 |
| Prince William | PRTC | **OmniRide North Route 1 (Dale City/Woodbridge - DC)** - Increase Frequency on OmniRide North Route 1 by | 2020 | 3,467 | 6,933 | $86.77 | $601,605 | $6,016,053 | 3 | $1,500,000 | 12 yr 40' - $500K | $1,500,000 | $7,516,053 | $3,008,027 | $4,508,027 | $12,371,070 | $5,177,598 | $7,193,472 |
| Prince William | PRTC | **OmniLink Route 1** - Extend OmniLink Route 1 to Ft. Belvoir during peak periods | 2020 | 2,080 | 2,288 | $86.77 | $198,530 | $1,985,298 | 1 | $325,000 | 12 yr - 30' Low Floor - $325K | $325,000 | $2,310,298 | $754,413 | $1,555,885 | $3,853,987 | $1,298,542 | $2,555,446 |
| Corridor-wide | VRE | **VRE Train Size** - Increase train size so that 3 of the Fredericksburg trains have 8 cars and 4 have six cars | 2015 | | | VRE estimated add'l cost associated with longer trains - 2 add'l 8 car trains @ $300,000/year | $600,000 | $9,000,000 | 6 | $12,600,000 | $2.1M/car | $12,600,000 | $21,600,000 | $9,000,000 | $12,600,000 | $28,627,263 | $14,020,410 | $14,606,853 |
| | | **TOTAL** | | **13,607** | **19,725** | | **$2,309,685** | **$33,116,817** | **14** | **$16,250,000** | | **$18,075,000** | **$51,191,817** | **$18,511,392** | **$32,680,425** | **$73,544,536** | **$29,125,584** | **$44,418,952** |

| New Shuttle/Feeder Bus Services | | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Summary Costs (2010 Dollars) | | | Summary Costs (Year of Expenditure) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Imple-menta-tion Year | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Vehicle Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Costs | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | Capital Cost | Total Costs (2010 Dollars) | Projected Farebox Revenue (2010 Dollars) | Net Total Costs (2010 Dollars) | Total Costs | Projected Farebox Revenue | Net Total Costs |
| Fairfax/ Springfield | Fairfax Connector | **Lorton VRE-EPG -Ft. Belvoir Shuttl**e - New "meet the train" shuttle between the Lorton VRE Station - EPG/Ft. Belvoir via Telegraph Rd, Fairfax County Parkway and Rolling Rd/Pohick Rd. | 2010 | 2,600 | 2,860 | $93.82 | $268,325 | $5,366,504 | 2 | $1,000,000 | 12 yr 40' - $500K | $2,000,000 | $7,366,504 | $1,073,301 | $6,293,203 | $10,120,385 | $1,538,925 | $8,581,460 |
| | | **TOTAL** | | **2,600** | **2,860** | | **$268,325** | **$5,366,504** | **2** | **$1,000,000** | | **$2,000,000** | **$7,366,504** | **$1,073,301** | **$6,293,203** | **$10,120,385** | **$1,538,925** | **$8,581,460** |

| New Bus/Rail Services | | | | Service Hours | | Operating Costs (2010 Dollars) | | | Capital Costs (2010 Dollars) | | | | Summary Costs (2010 Dollars) | | | Summary Costs (Year of Expenditure) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Imple-mentation Year | Additional Annual Revenue Hours | Additional Annual Vehicle Hours | Operating Cost/Vehicle Hour | Total Annual Operating Costs | 20-Year Operating & Maintenance Costs | Vehicle Needs | Potential Vehicle Costs | Vehicle Assumptions | Capital Cost | Total Costs (2010 Dollars) | Projected Farebox Revenue (2010 Dollars) | Net Total Costs (2010 Dollars) | Total Costs | Projected Farebox Revenue | Net Total Costs |
| Arlington/ Alexandria/DC | ART | **Shirlington - Rossyln** - New express route from Arlington I-395 southern area to northern area (Shirlington to Pentagon-Washington Blvd, Rosslyn area) | 2010 | 3,120 | 3,432 | $82.67 | $283,723 | $5,674,469 | 2 | $650,000 | 12 yr 30'- $325K | $1,300,000 | $6,974,469 | $1,418,617 | $5,555,852 | $9,712,936 | $2,034,048 | $7,678,888 |
| Prince William | PRTC | **Central Prince William - Downtown Alexandria -** New OmniRide Route along I-95 corridor serving East Eisenhower Valley and Downtown Alexandria west of Washington Street | 2010 | 3,120 | 6,240 | $86.77 | $541,445 | $10,828,896 | 4 | $2,000,000 | 12 yr 40'- $500K | $4,000,000 | $14,828,896 | $5,414,448 | $9,414,448 | $20,378,256 | $7,763,367 | $12,614,889 |
| Fairfax/ Springfield | WMATA | **Kingstowne - Shirlington** - **Pentagon** - New express route serving Kingstown-Van Dorn-Shirlington. Start at Kingstown, stop at Van Dorn Metro, then travel along Van Dorn Avenue, Landmark Mall, Van Dorn Avenue, Sanger, Beauregard Street, Walter Reed Drive, and Arlington Mill Road, Shirlington, and then the HOT lanes to Pentagon. This service would be a limited stop service, possibly using some exclusive transitways in Alexandria. | 2010 | 18,200 | 20,020 | $95.24 | $1,906,705 | $38,134,096 | 5 | $2,500,000 | 12 yr 40'- $500K | $5,000,000 | $43,134,096 | $11,440,229 | $31,693,867 | $60,741,995 | $16,403,278 | $44,338,717 |
| Prince William/Fairfax | PRTC | **Woodbridge - Lorton - Tysons Corner** - **Merrifield -** New peak period OmniRide express route from East PW to the new Lorton VRE easy on/off to Tysons Corner and Merrifield. | 2015 | 3,120 | 6,240 | $86.77 | $541,445 | $8,121,672 | 4 | $2,000,000 | 12 yr 40'- $500K | $4,000,000 | $12,121,672 | $4,060,836 | $8,060,836 | $18,276,374 | $6,326,065 | $11,950,308 |
| Prince William | PRTC | **Lake Ridge - Seminary Road Area -** New OmniRide Express Route serving Skyline, Bailey's Crossroads and Mark Center via Seminary Road | 2020 | 2,080 | 4,160 | $86.77 | $360,963 | $3,609,632 | 3 | $1,500,000 | 12 yr 40'- $500K | $1,500,000 | $5,109,632 | $1,804,816 | $3,304,816 | $8,228,992 | $3,106,559 | $5,122,433 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - Pentagon/Crystal City** - New Express/BRT route from Fredericksburg to Pentagon/Crystal City | 2020 | 5,200 | 10,400 | $86.77 | $902,408 | $9,024,080 | 6 | $3,000,000 | 12 yr 40'- $500K | $3,000,000 | $12,024,080 | $5,414,448 | $6,609,632 | $19,564,543 | $7,766,397 | $11,798,146 |
| Stafford/ Fredericksburg | FAMPO | **Fredericksburg - DC** - New Express/BRT route from Fredericksburg to DC core (when combined with Massaponax in 2020, services would operate alternating 15 min) | 2015 | 6,240 | 12,480 | $86.77 | $1,082,890 | $16,243,344 | 6 | $3,000,000 | 12 yr 40'- $500K | $6,000,000 | $22,243,344 | $8,121,672 | $14,121,672 | $33,740,625 | $12,652,130 | $21,088,495 |
| Stafford/ Fredericksburg | FAMPO | **Massaponax - DC** - New Express/BRT route from Massaponax to DC core (when combined with Fredericksburg, services would operate alternating 15 min) | 2020 | 6,240 | 12,480 | $86.77 | $1,082,890 | $10,828,896 | 6 | $3,000,000 | 12 yr 40'- $500K | $3,000,000 | $13,828,896 | $5,414,448 | $8,414,448 | $22,671,102 | $9,319,676 | $13,351,425 |
| | | **TOTAL** | | **47,320** | **75,452** | | **$6,702,468** | **$102,465,085** | **36** | **$17,650,000** | | **$27,800,000** | **$130,265,085** | **$43,089,514** | **$87,175,571** | **$193,314,822** | **$65,371,520** | **$127,943,302** |

| Fixed Facilities | | | | | Capital Costs (2010 Dollars) | | | Summary Costs (2010 Dollars) | | | Summary Costs (Year of Expenditure) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Originating Area | Operator | Description | Imple-menta-tion Year | | Capital Needs | Potential Capital Costs | Capital Assumptions | Total Costs (2010 Dollars) | Projected Farebox Revenue (2010 Dollars) | Net Total Costs (2010 Dollars) | Total Costs | Projected Farebox Revenue | Net Total Costs |
| Arlington/ Alexandria/DC | WMATA | **Pentagon Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security) | 2010 | | Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements | $2,500,000 | $2.5M per station | $2,500,000 | NA | $2,500,000 | $2,500,000 | NA | $2,500,000 |
| Fairfax/ Springfield | Fairfax Connector | **Franconia-Springfield Metrorail Transit Center -** Improvements (additional bus bays, real time information, traffic circulation/access/egress, and security) | 2010 | | Three (3) additional bus bays (including canopy), real time information, traffic circulation/access/security improvements | $2,500,000 | $2.5M per station | $2,500,000 | NA | $2,500,000 | $2,500,000 | NA | $2,500,000 |
| Corridor-wide | | **Additional park-and-ride lot capacity** at various locations (new and/or existing lots); 175 spaces for the Fredericksburg subarea; 1,075 spaces for the North Stafford subarea; 250 spaces for the Potomac Mills subarea; and 1,500 spaces for the VRE stations | 2010 | | 3,000 additional spaces beyond 3,000 currently proposed by Fluor/Transurban | | $10,000 per VDOT space; $15,000 per VRE space | $37,500,000 | NA | $37,500,000 | $37,500,000 | NA | $37,500,000 |
| Corridor-wide | VRE | **Platform Extensions** at selected stations | 2015 | | 4 stations on Fredericksburg Line would need platform extensions for "low" or "medium" alternatives | $4,000,000 | $1M to extend 300' including canopy | $4,000,000 | NA | $4,000,000 | $4,637,096 | NA | $4,637,096 |
| Fredericksburg | FAMPO | **Transit Center** at Massaponax | 2020 | | | $1,500,000 | | $1,500,000 | NA | $1,500,000 | $2,015,875 | NA | $2,015,875 |
| Corridor-wide | | **BRT in-line transit stations** along the corridor - 5 stations but 4 in-line stations included in cost (Lorton is being paid for by Fluor/TransUrban as part of the HOT Lanes project) | 2020 | | | $40,000,000 | $10M per station (not including parking) | $40,000,000 | NA | $40,000,000 | $53,756,655 | NA | $53,756,655 |
| Corridor-wide | VRE | **Overnight Storage in Fredericksburg** | 2015 | | | $1,350,000 | | $1,350,000 | NA | $1,350,000 | $1,565,020 | NA | $1,565,020 |
| | | | | | | | **TOTAL** | **$89,350,000** | **NA** | **$89,350,000** | **$104,474,646** | NA | **$104,474,646** |

| TDM Program Elements | | | Summary Costs (2010 Dollars) | | | Summary Costs (Year of Expenditure) | | |
|---|---|---|---|---|---|---|---|---|
| Originating Area | Description | | Total Costs (2010 Dollars) | Projected Farebox Revenue (2010 Dollars) | Net Total Costs (2010 Dollars) | Total Costs | Projected Farebox Revenue | Net Total Costs |
| Corridor-wide | **Capital Assistance For Vanpools -** Provide financial assistance for the purchase or lease of vans for vanpools. Incentives, IT monitoring and reporting of vanpool mileage, and promotion of Capital cost of Contracting for vanpools. Provide free electronic toll transponders to vanpools. | | $5,000,000 | NA | $5,000,000 | $7,169,121 | NA | $7,169,121 |
| Corridor-wide | **Enhanced Guaranteed Ride Home -** Enhanced promotion and operation of Guaranteed Ride Home (GRH) services in the extended corridor. Offers free taxi or rental car transportation to registered commuters who use alternative modes and have a personal emergency during the workday. | | $200,000 | NA | $200,000 | $286,765 | NA | $286,765 |
| Corridor-wide | **Carpool Incentives -** Rewards and incentives for carpoolers. | | $3,000,000 | NA | $3,000,000 | $4,301,473 | NA | $4,301,473 |
| Corridor-wide | **Rideshare Program Operational Support -** Additional staff for commuter assistance programs in the corridor and feeder markets to promote TDM programs and transit. | | $600,000 | NA | $600,000 | $860,295 | NA | $860,295 |
| Corridor-wide | **TDM Programs Marketing -** Expand marketing efforts touting TDM programs and non-SOV commute modes in the corridor and feeder markets. | | $5,000,000 | NA | $5,000,000 | $7,169,121 | NA | $7,169,121 |
| Corridor-wide | **Telework Program Assistance -** Financial incentives and assistance to increase the number of workers teleworking. | | $4,000,000 | NA | $4,000,000 | $5,735,297 | NA | $5,735,297 |
| Corridor-wide | **Vanpool Driver Incentives -** Provide incentives to get new drivers and retain existing drivers for vanpools. | | $700,000 | NA | $700,000 | $1,003,677 | NA | $1,003,677 |
| Corridor-wide | **Vanpool Insurance -** Increase vanpool insurance premium pool buy-down for vanpools. | | $500,000 | NA | $500,000 | $716,912 | NA | $716,912 |
| Corridor-wide | **VanStart/VanSave -** Additional financial support to cover the cost of vacant seats for new vanpools during start-up operations, and established vanpools that have temporary vacancies. Support is short-term, one to six months, until regular riders are found to fill vacant seats. | | $1,000,000 | NA | $1,000,000 | $1,433,824 | NA | $1,433,824 |
| | | **TOTAL** | **$20,000,000** | **NA** | **$20,000,000** | **$ 28,676,486** | **NA** | **$28,676,486** |

| | Operating | Capital | Total | Farebox | NET COST | Total | Farebox | NET COST |
|---|---|---|---|---|---|---|---|---|
| **Total** | **$160,948,405** (includes TDM) | **$137,225,000** | **$298,173,405** | **$62,674,207** | **$235,499,199** | **$410,130,874** | **$96,036,028** | **$314,094,846** |

# I-95/I-395 Transit/TDM Study
# Appendices

FEBRUARY 29, 2008

Developed by
I-95/I-395 Transit/TDM Technical Advisory Committee

Project Lead
Virginia Department of Rail and Public Transportation
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P.O. Box 590 • Richmond, VA 23218-0590
www.drpt.virginia.gov

# I-95/I-395 Transit/TDM Study

# Appendices

Developed by

I-95/I-395 Transit/TDM Technical Advisory Committee

**February 29, 2008**

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# Appendix A

# Appendix A – List of Acronyms

**CLRP –** Constrained Long-Range Transportation Plan

**CMP –** Congestion Management Program

**CPI –** Consumer price index

**CR –** Commuter rail

**CS –** Cambridge Systematics, Inc.

**CTPP –** Census Transportation Planning Package

**DA –** Drive-alone

**DRPT –** Virginia Department of Rail and Public Transportation

**FAMPO –** Fredericksburg Area Metropolitan Planning Organization

**FHWA –** Federal Highway Administration

**FRED –** Fredericksburg Regional Transit

**FTA –** Federal Transit Administration

**GWRC –** George Washington Regional Commission

**HBW –** Home-based work

**HR –** Heavy rail

**HOT –** High-occupancy toll

**HOV –** High-occupancy vehicle

**KNR –** Kiss-and-ride

**KFH –** KFH Group

**LDAC –** LDA Consulting

**LOV –** Low-occupancy vehicles

**MB –** Motor bus

**MB-HR –** Motor bus to metro

**MWCOG –** Metropolitan Washington Council of Governments

**Non-DA –** Nondrive-alone

**NTD –** National Transit Database

**NVTA –** Northern Virginia Transportation Authority

**NVTC –** Northern Virginia Transportation Commission

**O-D –** Origin-destination

**PRTC –** Potomac and Rappahannock Transportation Commission

**ROI –** Return on Investment

**SIR –** Southeastern Institute of Research

**SOC –** State of the Commute

**SOV –** Single-occupant vehicle

**TAC –** Technical Advisory Committee

**TAZ –** Traffic analysis zones

**TDM –** Transportation demand management

**TERM –** Transportation Emission Reduction Measure

**VDOT –** Virginia Department of Transportation

**VMT –** Vehicle-miles traveled

**VRE –** Virginia Railway Express

**WGA –** William G. Allen

**WMATA –** Washington Metropolitan Area Transit Authority

# Appendix B

# Appendix B – Transit Opportunity Maps

Transit market opportunity maps were developed to highlight the travel flows between origins within the study area and major destinations based on the MWCOG regional activity centers in order to facilitate the development of the baseline scenario and potential transit markets. The rest of the maps are provided in Appendix B. These maps served as a useful device for soliciting TAC input on existing and planned transit service (including express bus/bus rapid transit, Metrorail, and commuter rail services) and TDM programs (including slugging, carpooling, van-pooling, and park-and-ride facilities) in the I-95, I-395, I-495, and Route 1 corridors.

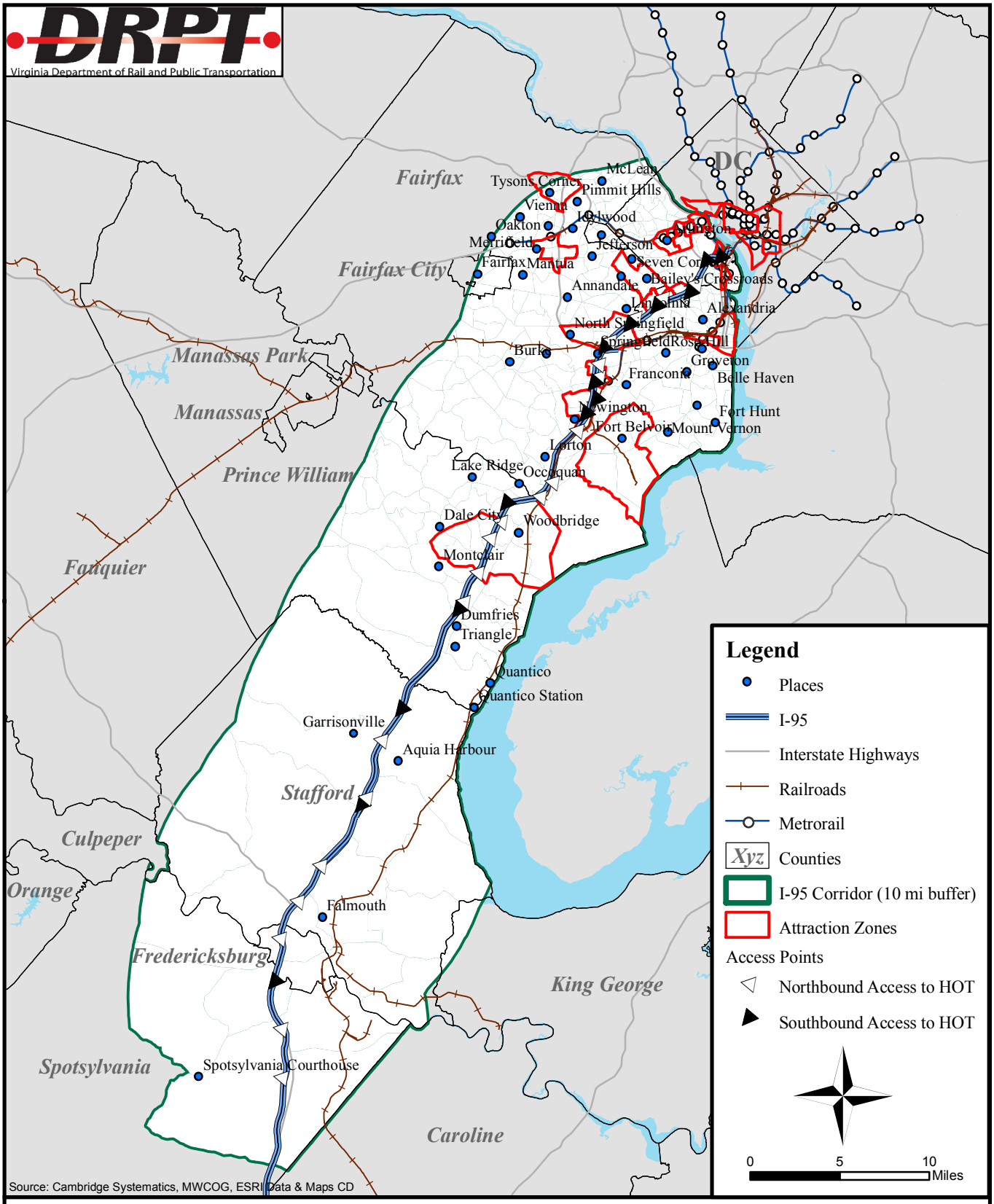



Figure 1

MAJOR ATTRACTION ZONES FOR 2015 PROJECTED
HOME-BASED WORK TRIPS ORIGINATING IN THE I-95 CORRIDOR

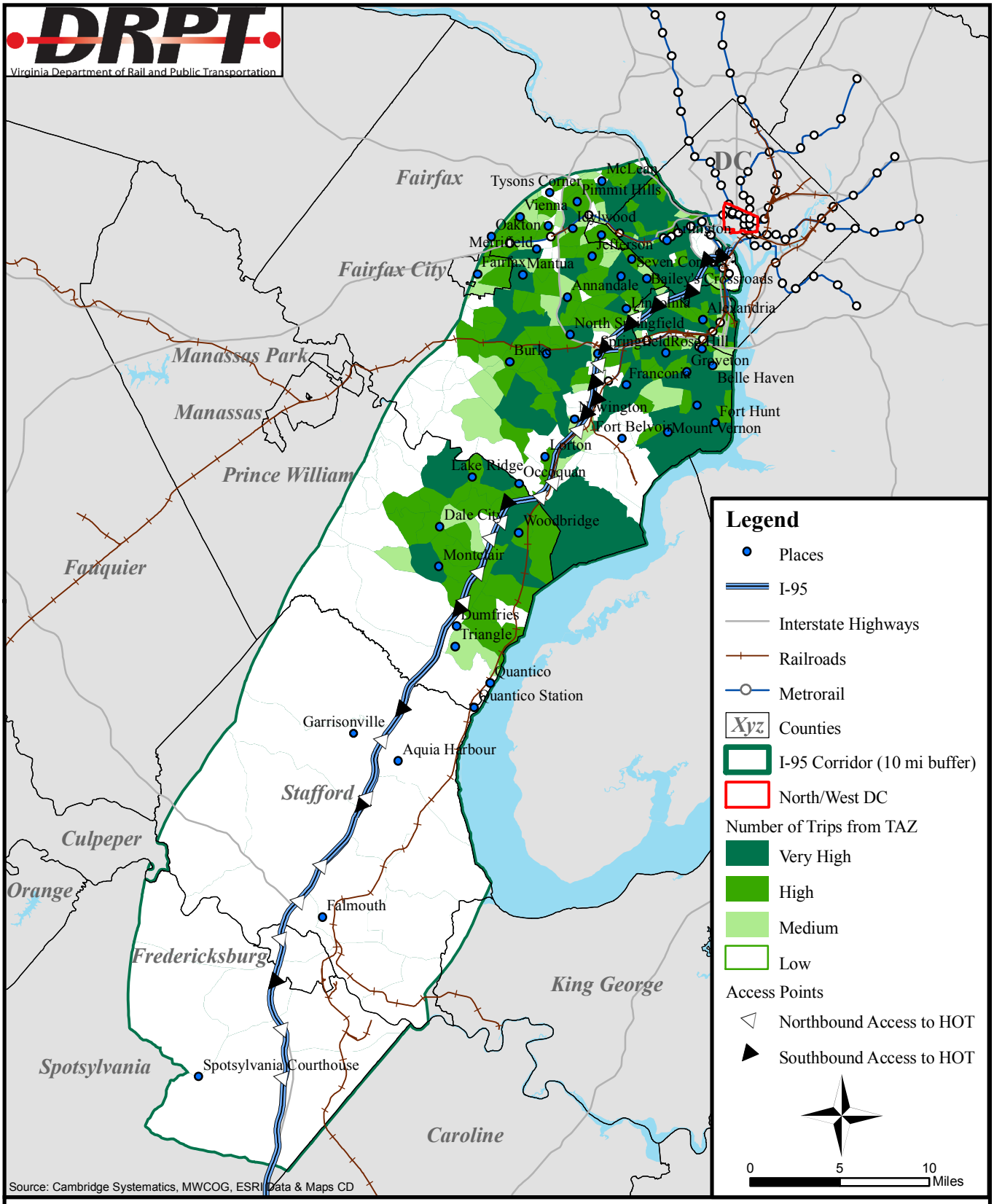



Figure 2

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO NORTH/WEST DC
(without I-95/I-395 HOT Lanes)

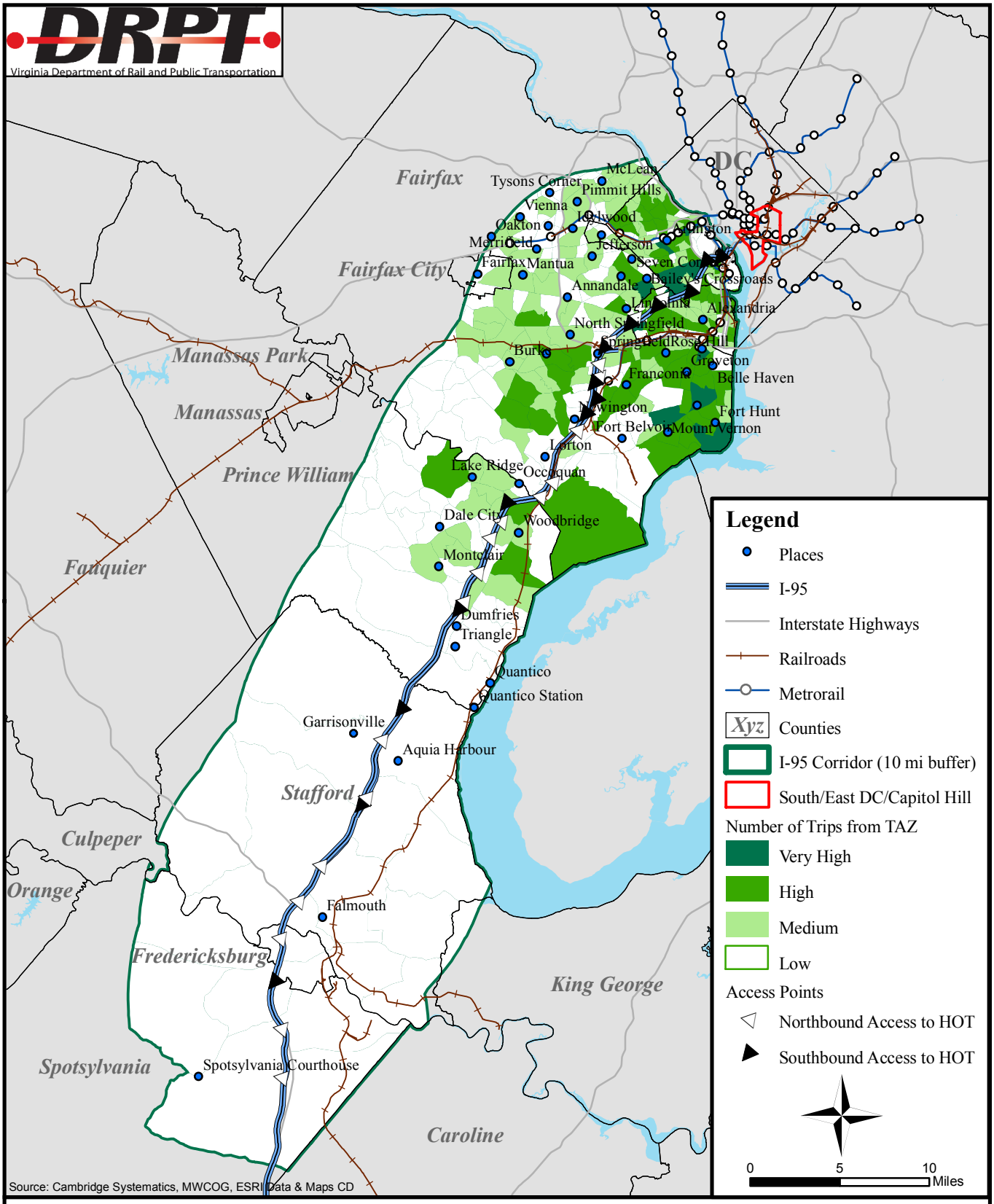



Figure 3

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK PERIOD
FROM I-95 CORRIDOR TO SOUTH/EAST DC INCLUDING CAPITOL HILL
(without I-95/I-395 HOT Lanes)

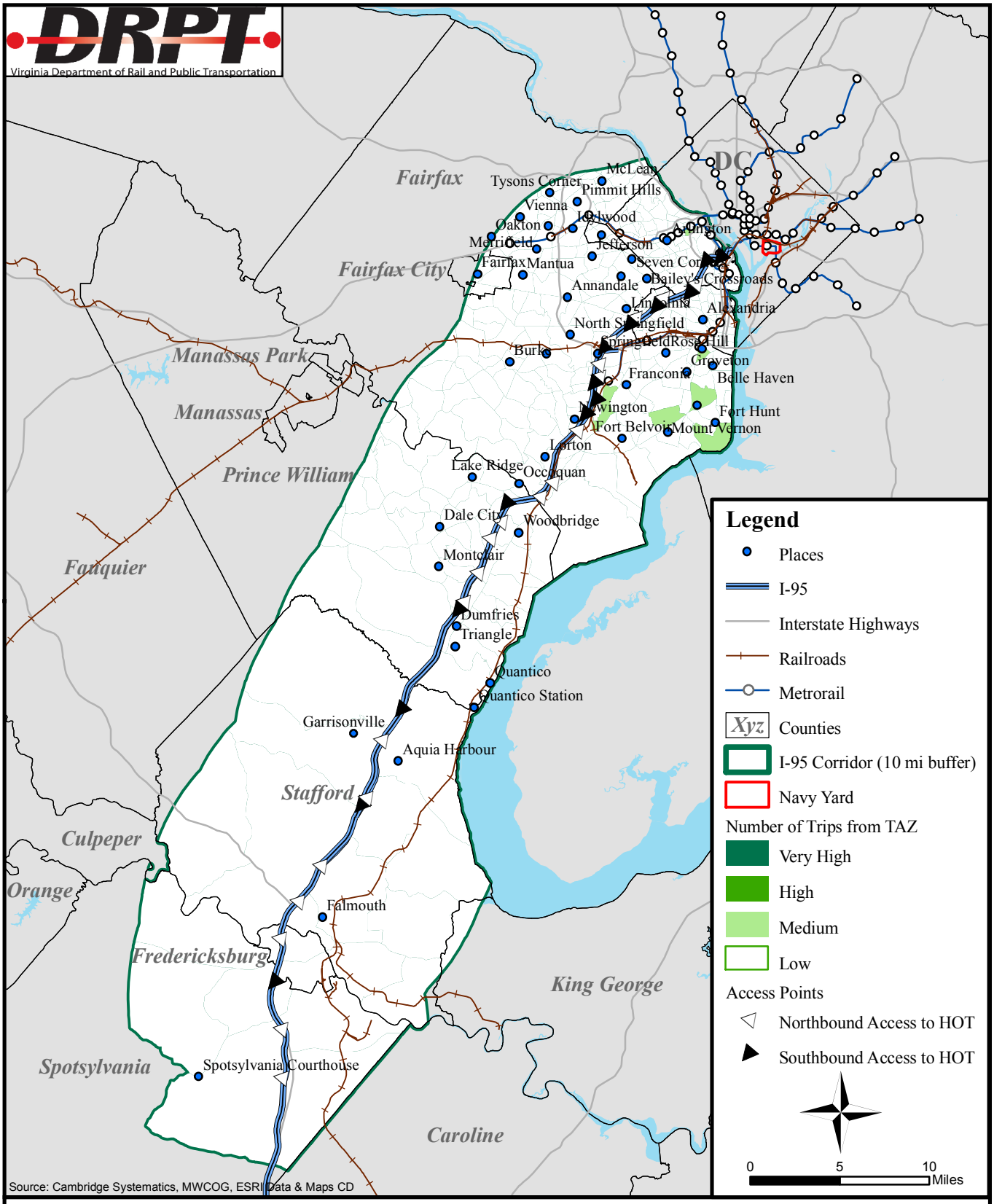



Figure 4

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO NAVY YARD
(without I-95/I-395 HOT Lanes)

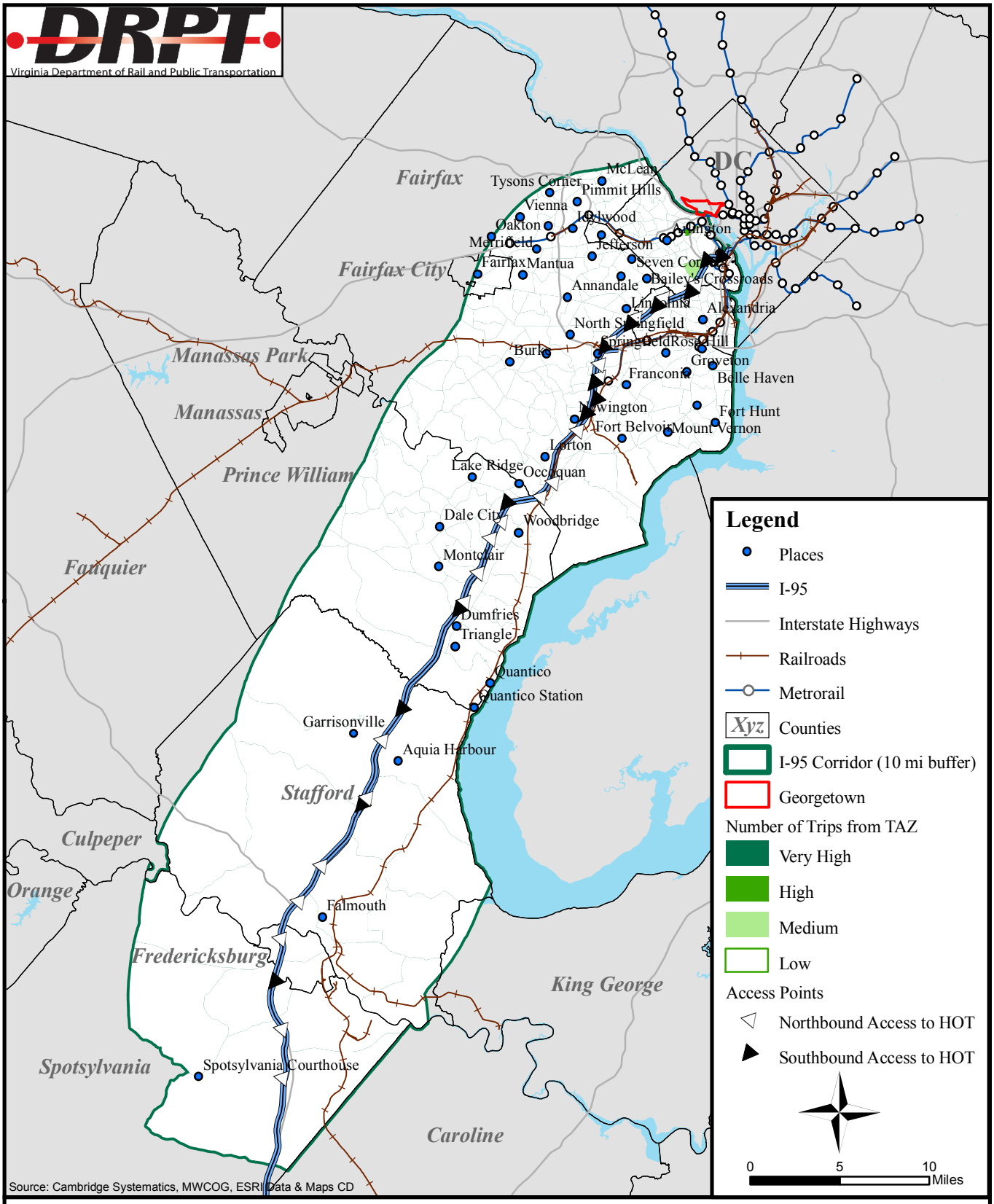



Figure 5

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO GEORGETOWN
(without I-95/I-395 HOT Lanes)

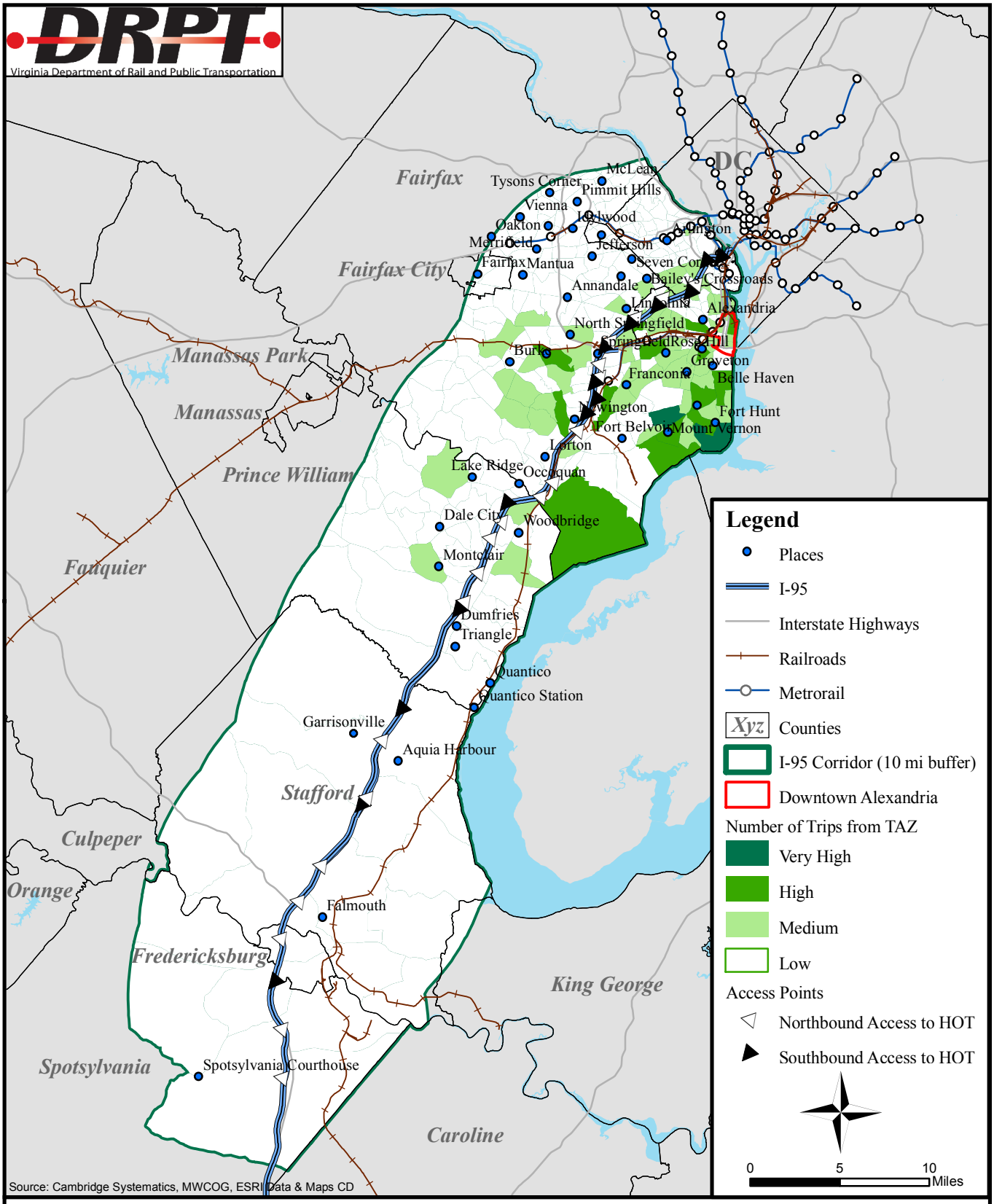



Figure 6

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO DOWNTOWN ALEXANDRIA
(without I-95/I-395 HOT Lanes)

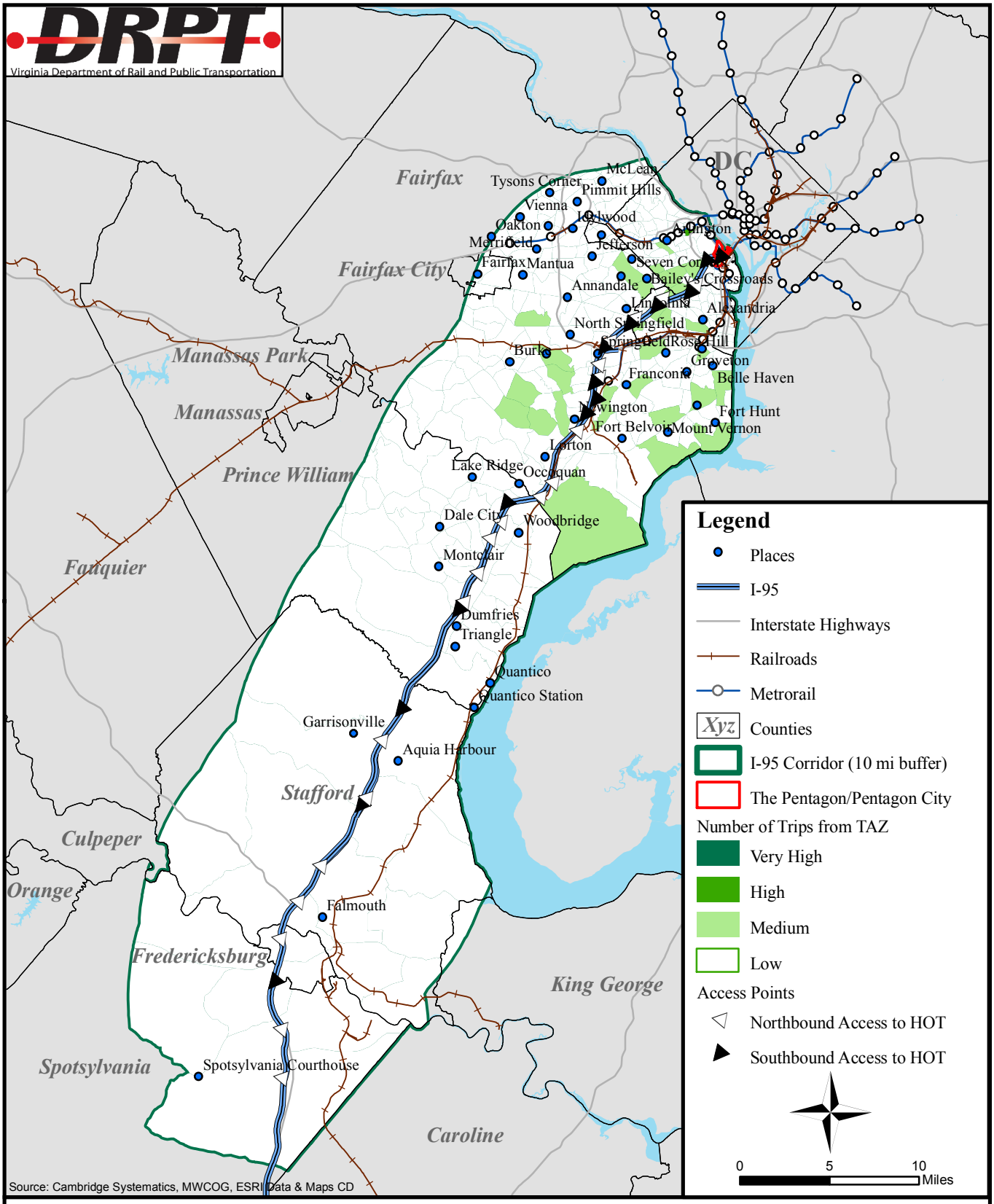



Figure 7

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK
PERIOD FROM I-95 CORRIDOR TO THE PENTAGON AND PENTAGON CITY
(without I-95/I-395 HOT Lanes)

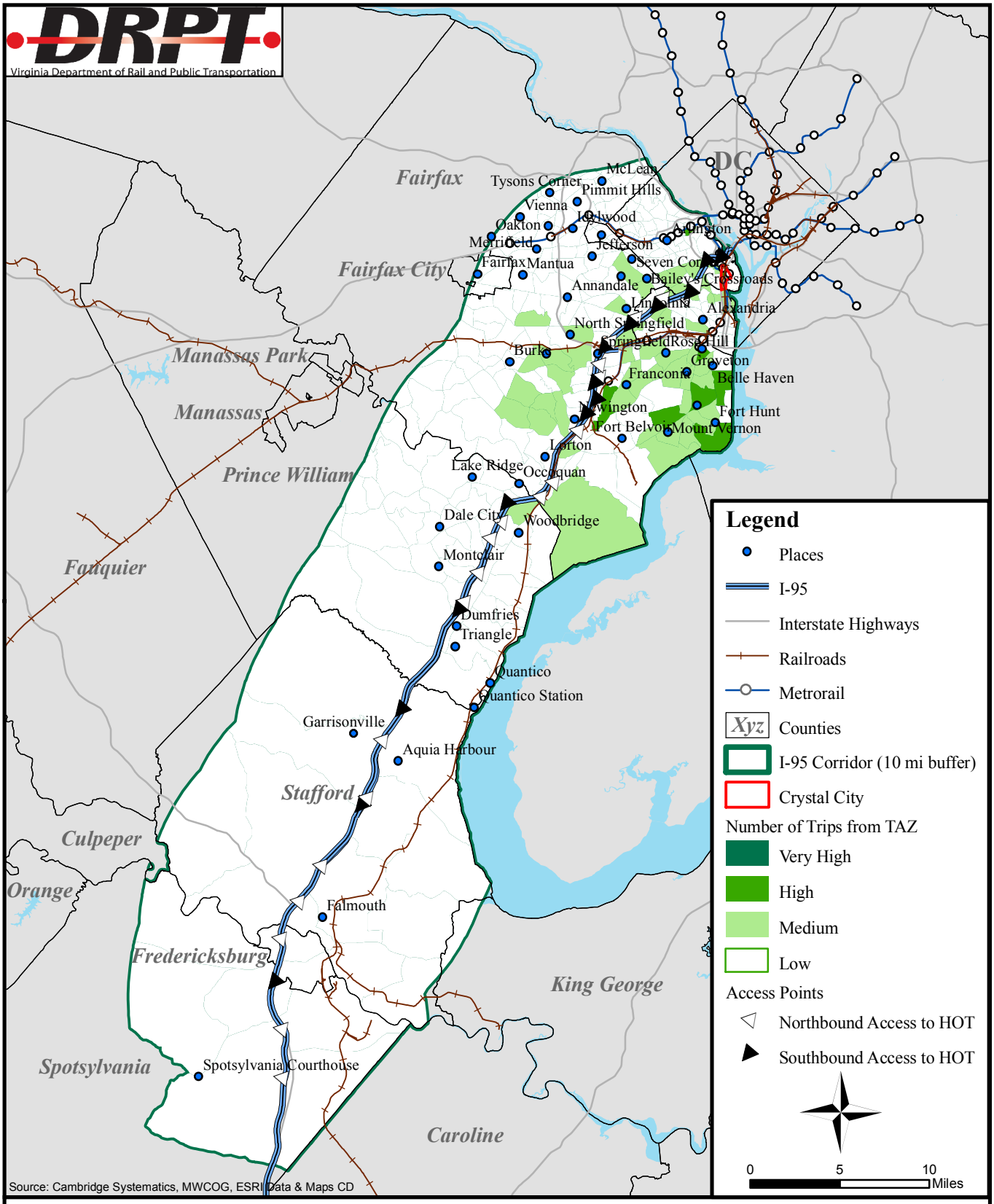



Figure 8

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO CRYSTAL CITY
(without I-95/I-395 HOT Lanes)

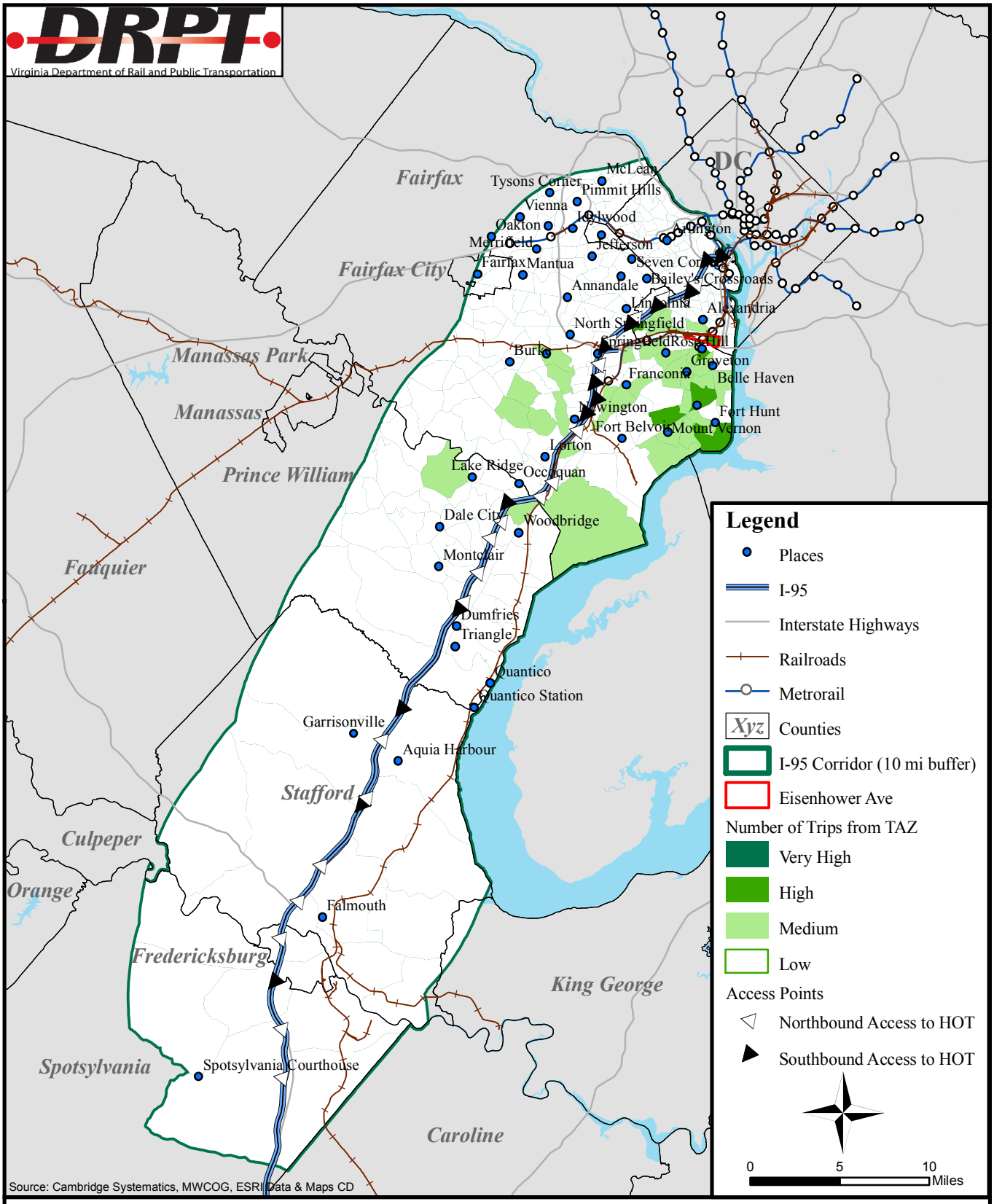



Figure 9

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO EISENHOWER AVE
(without I-95/I-395 HOT Lanes)

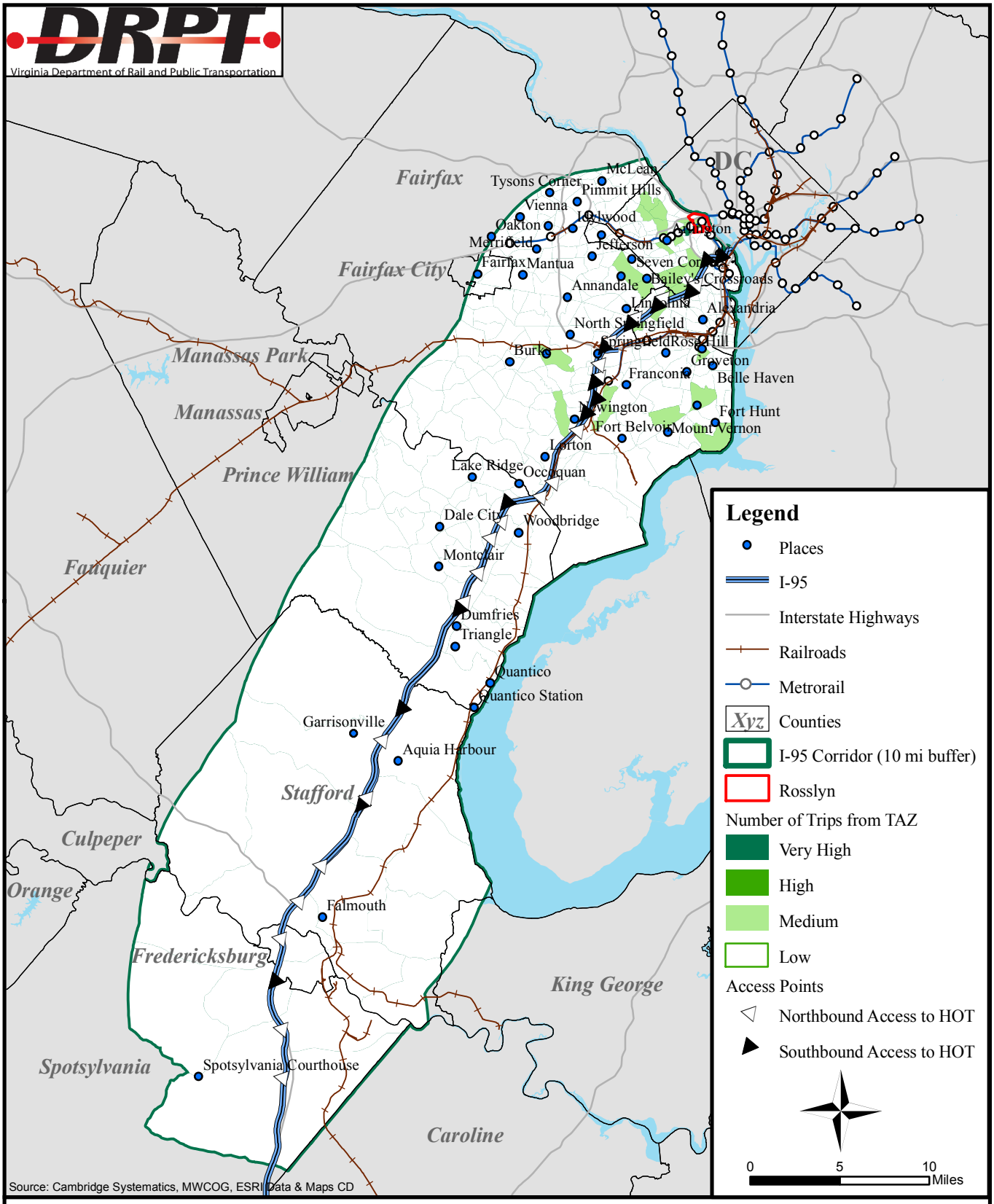



Figure 10

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO ROSSLYN
(without I-95/I-395 HOT Lanes)

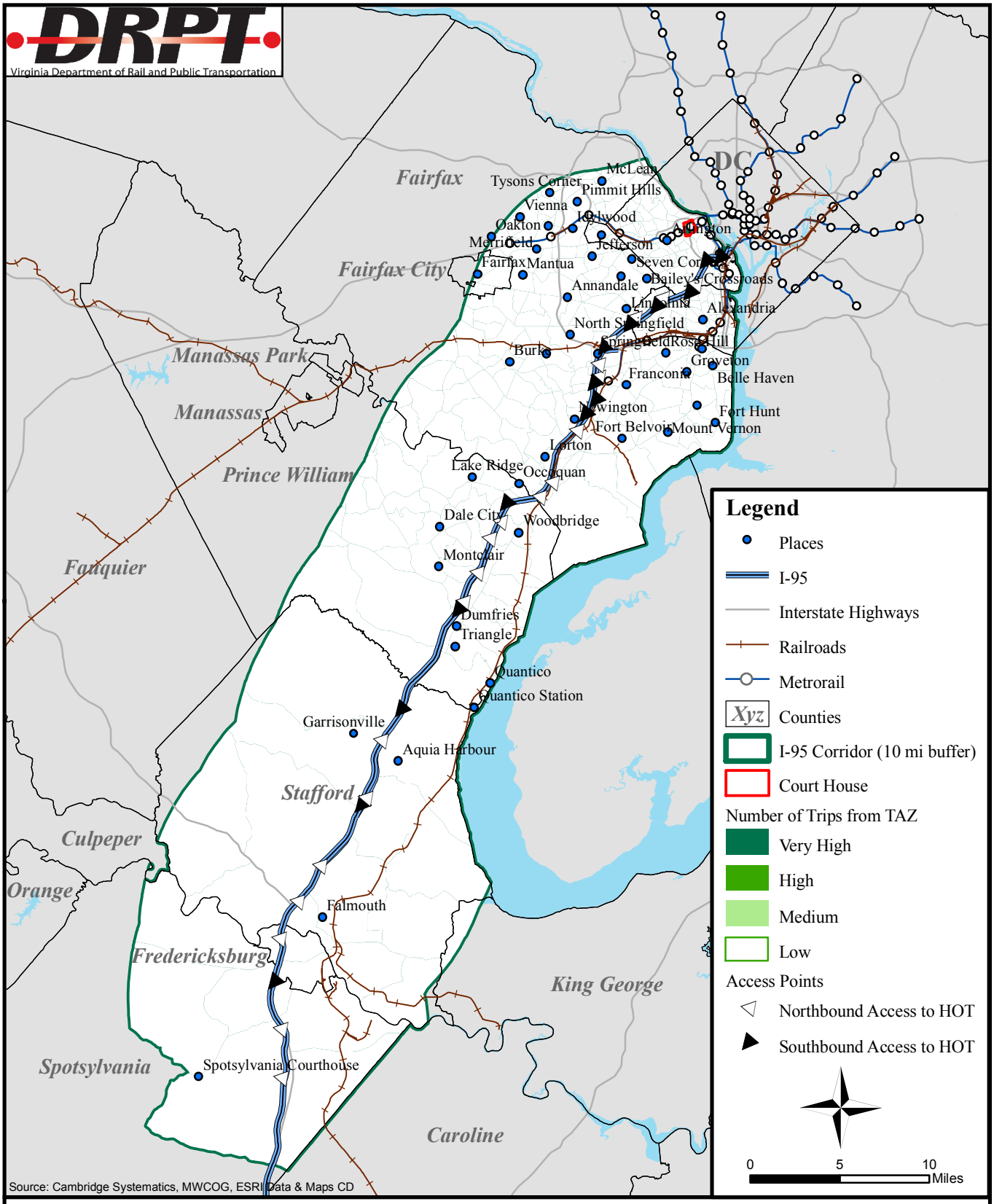



Figure 11

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO COURT HOUSE
(without I-95/I-395 HOT Lanes)

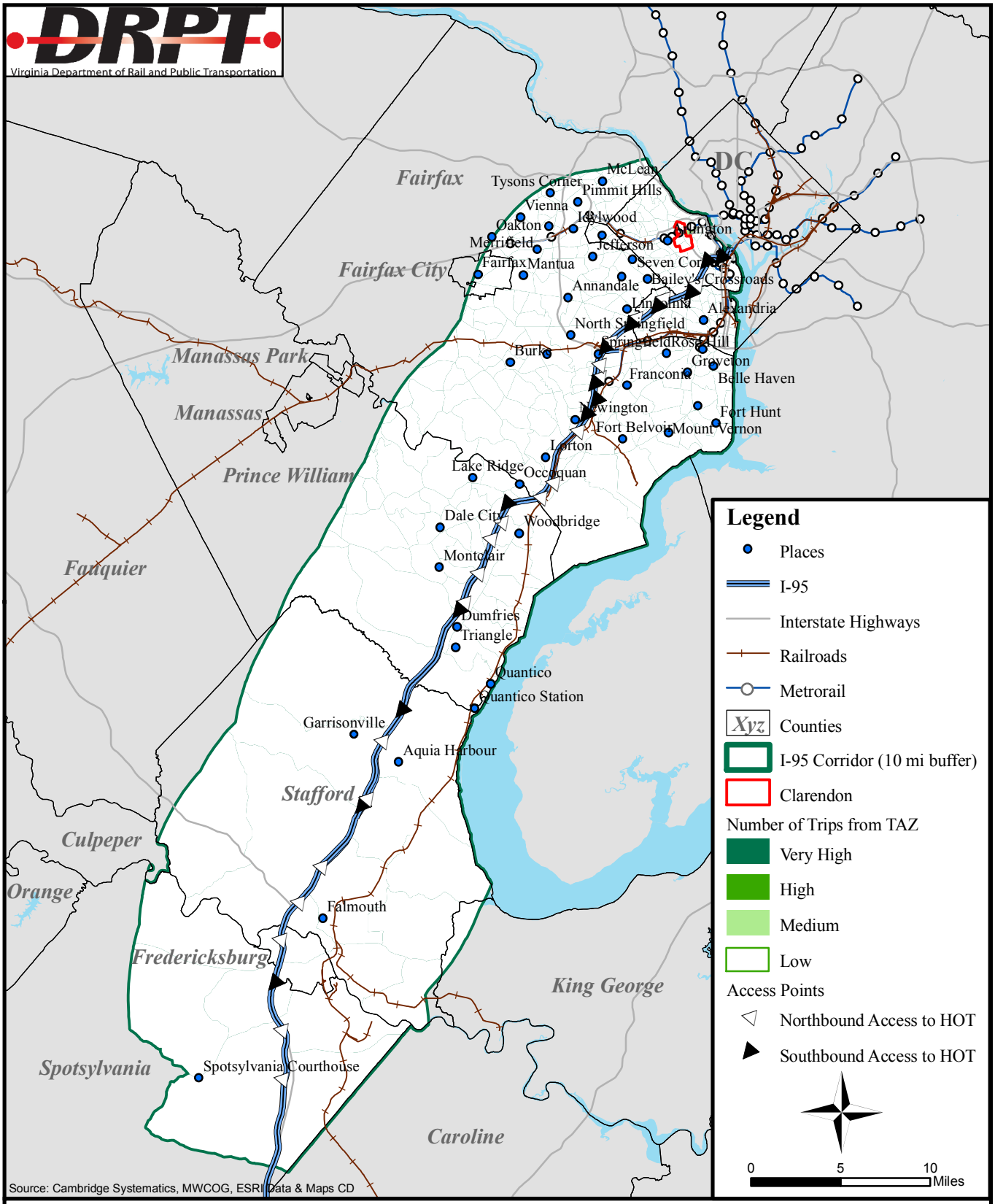



Figure 12

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO CLARENDON
(without I-95/I-395 HOT Lanes)

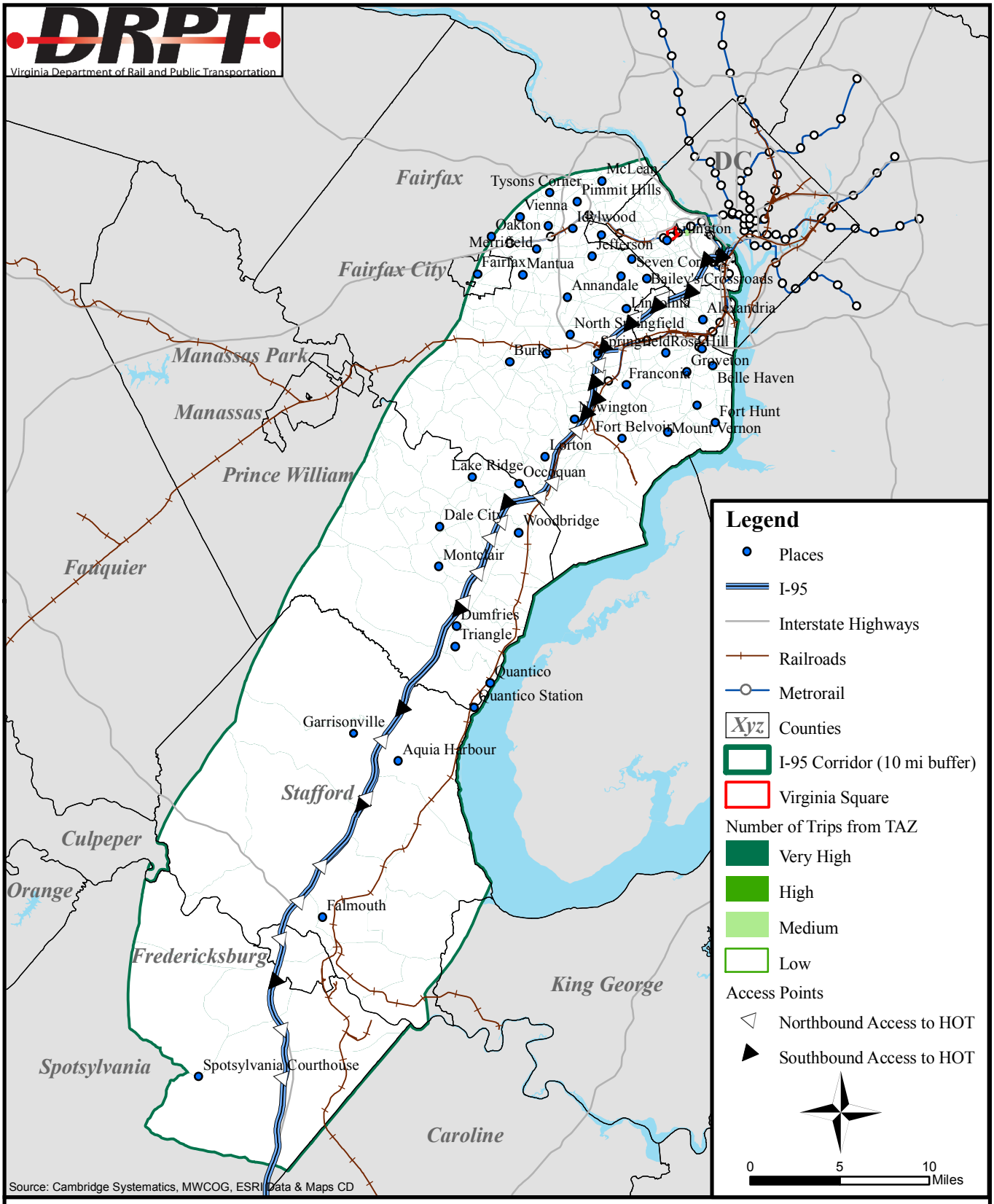



Figure 13

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO VIRGINIA SQUARE
(without I-95/I-395 HOT Lanes)

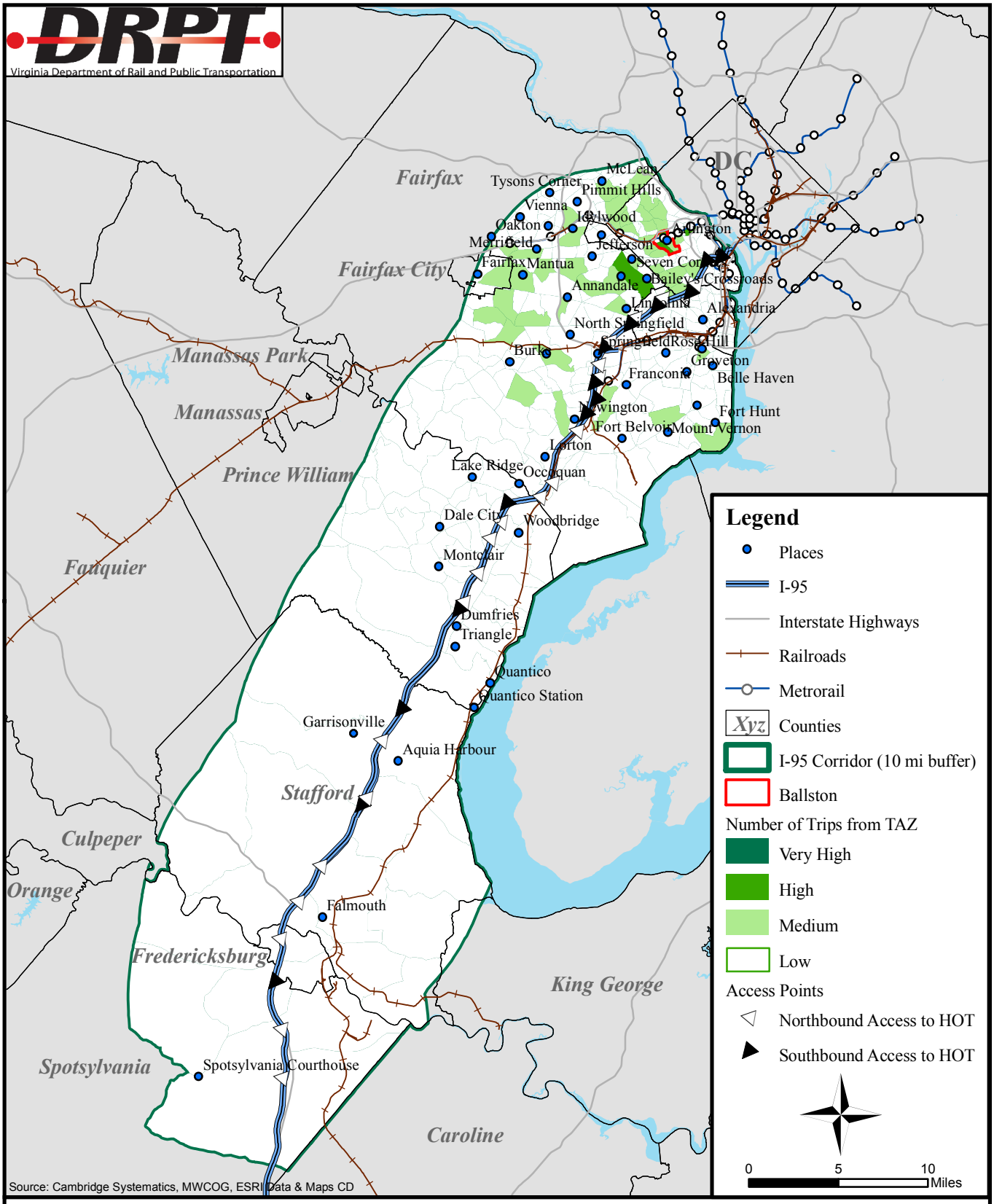



Figure 14

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO BALLSTON
(without I-95/I-395 HOT Lanes)

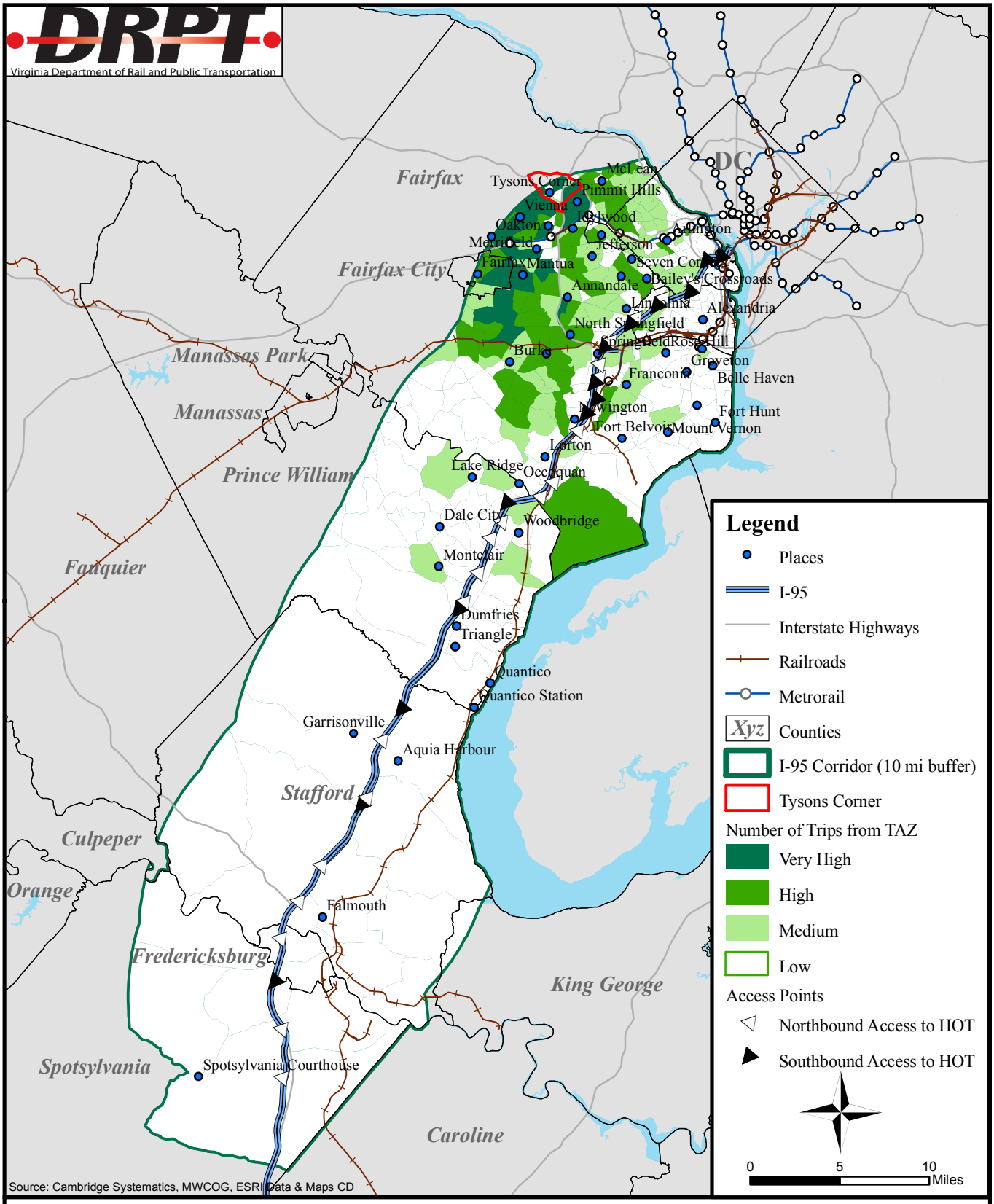



Figure 15

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO TYSONS CORNER
(without I-95/I-395 HOT Lanes)

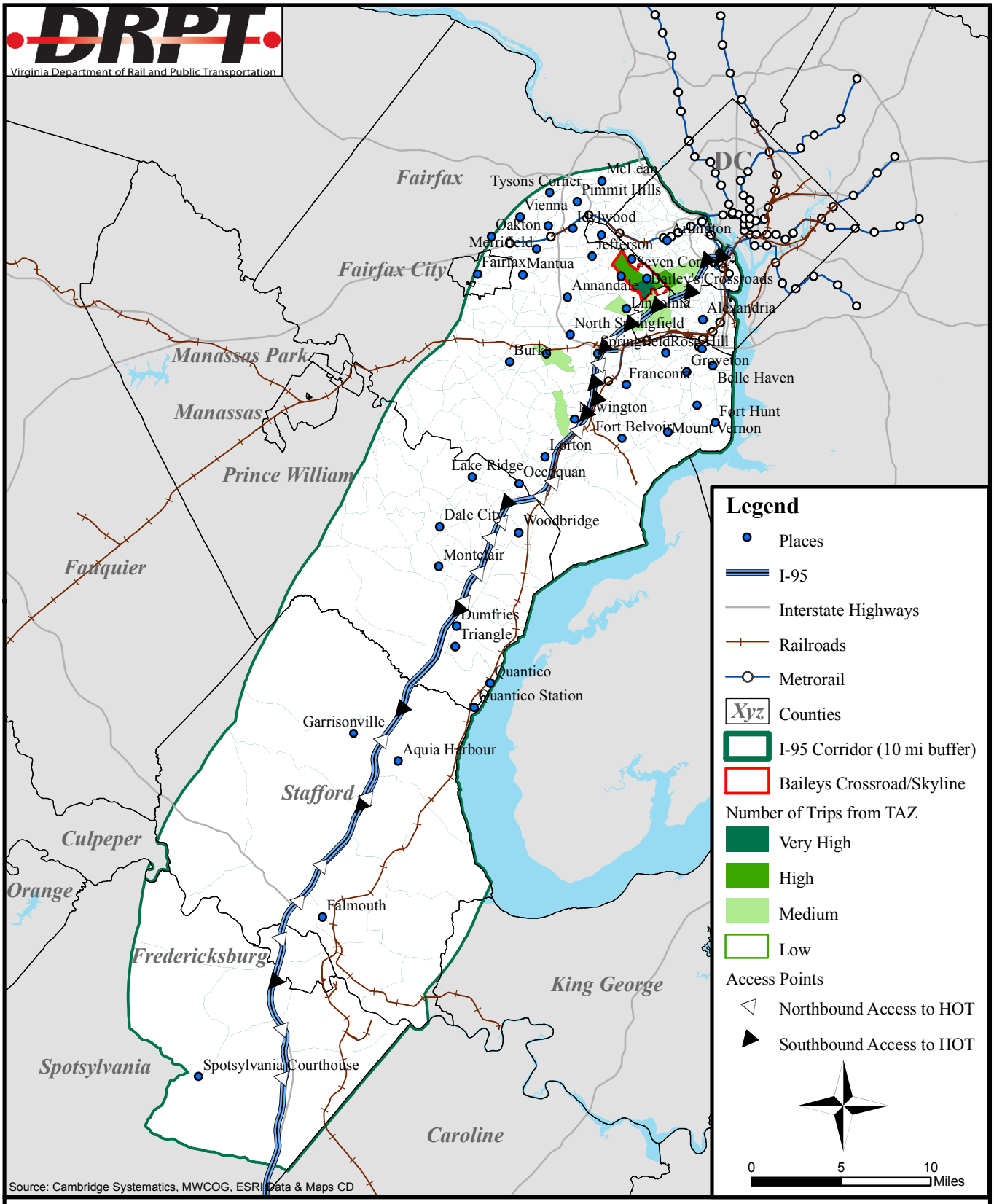



Figure 16

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK PERIOD FROM I-95 CORRIDOR TO BAILEYS CROSSROAD/SKYLINE (without I-95/I-395 HOT Lanes)

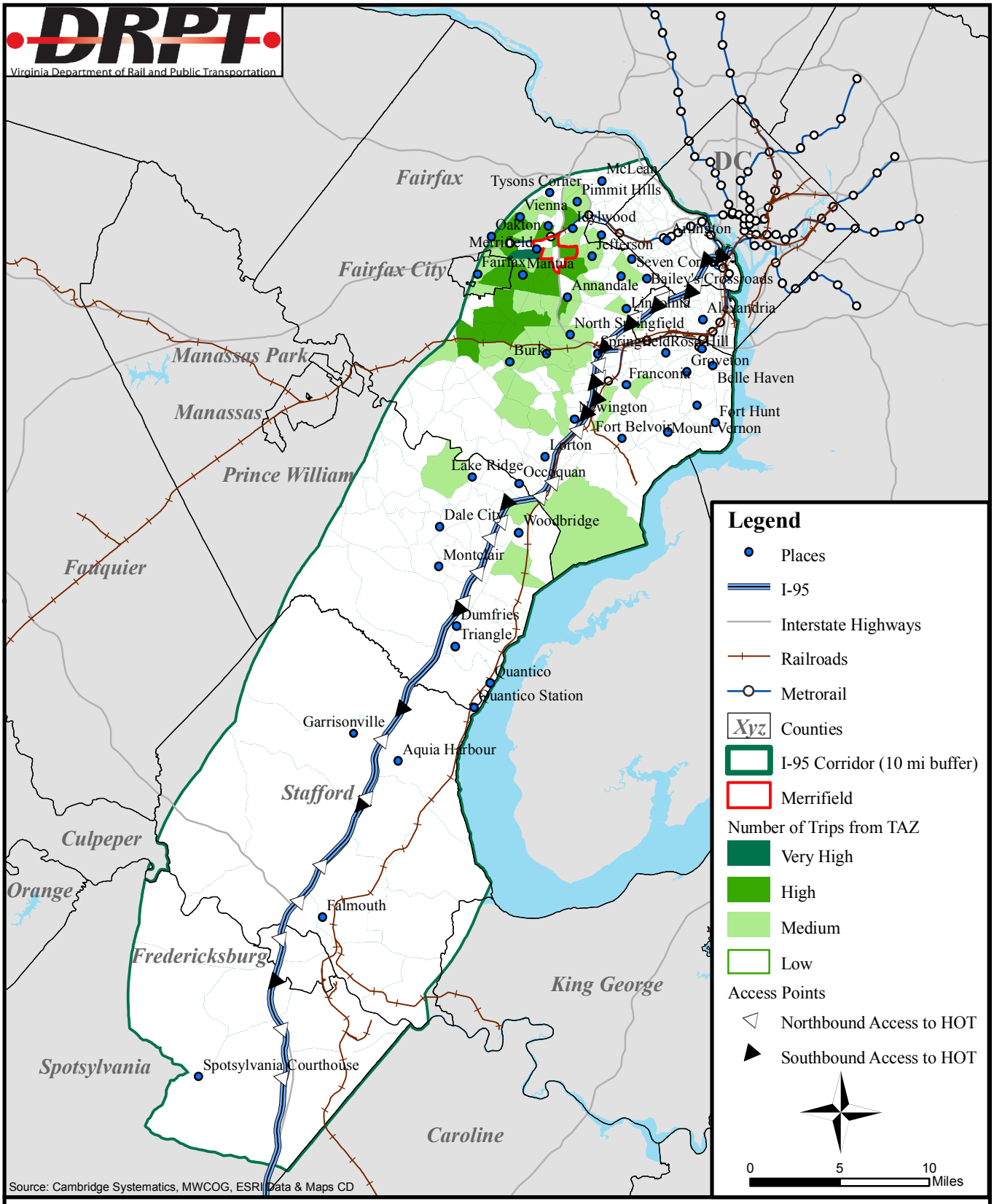



Figure 17

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO MERRIFIELD
(without I-95/I-395 HOT Lanes)

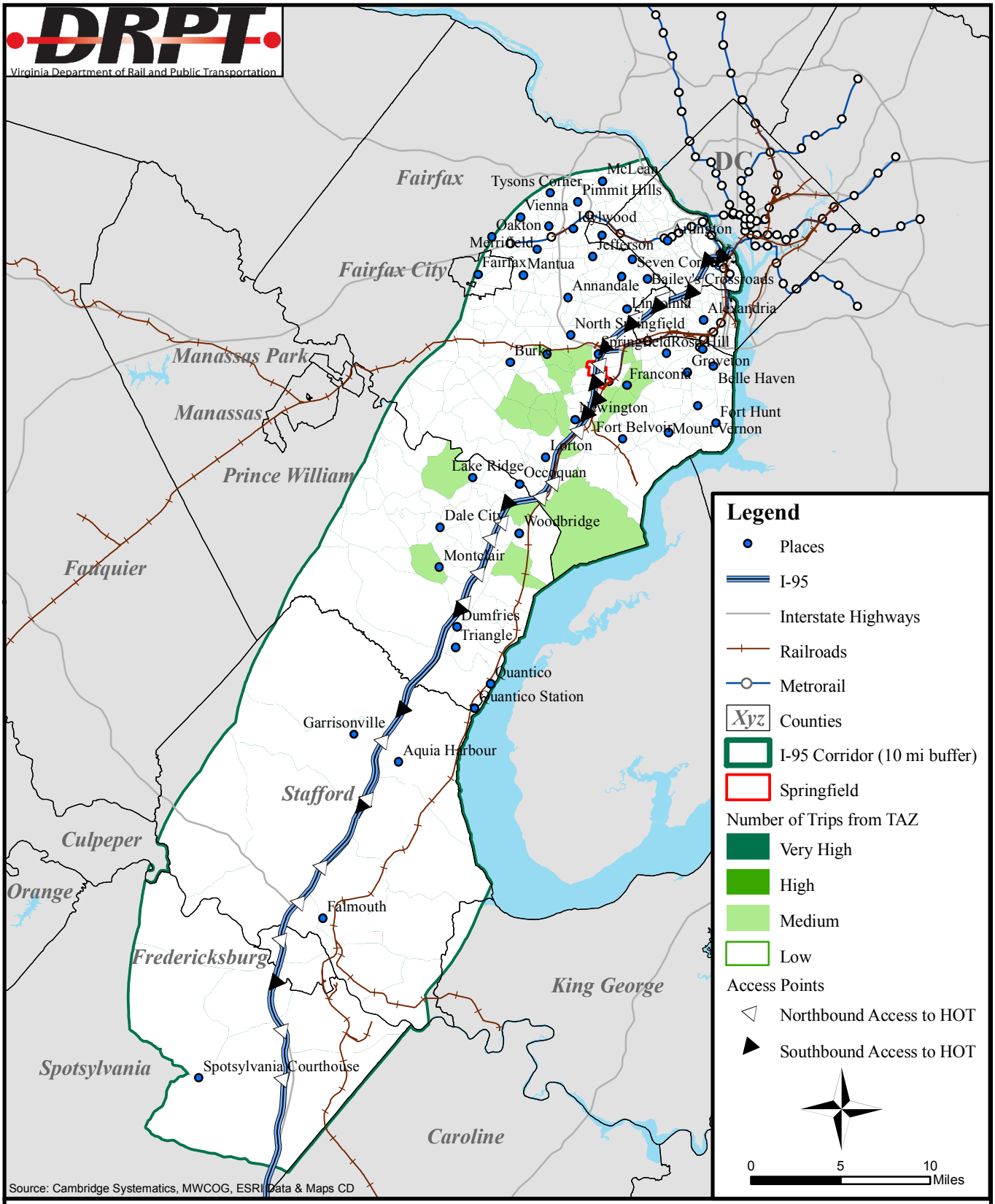



Figure 18

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO SPRINGFIELD
(without I-95/I-395 HOT Lanes)

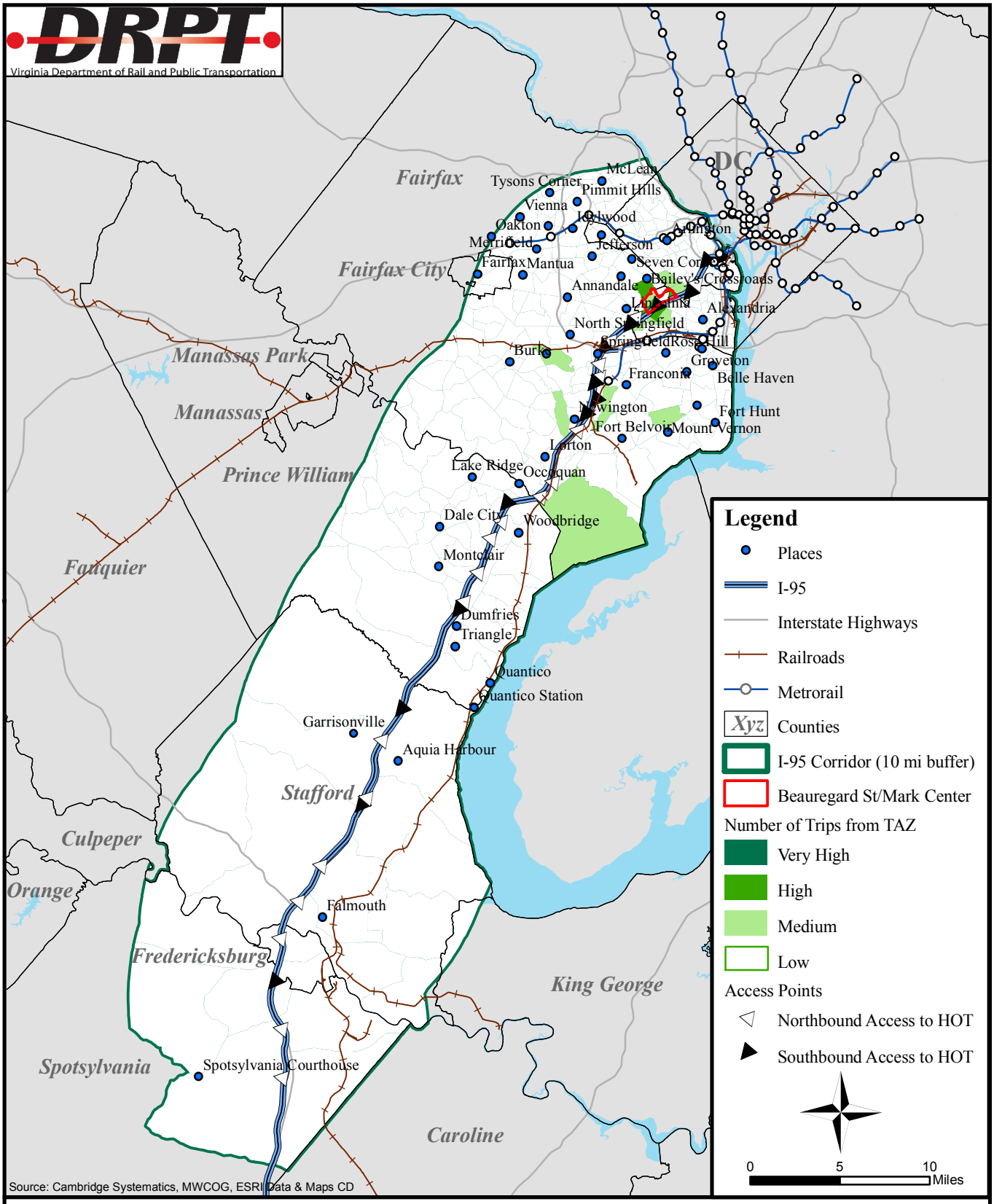



Figure 19

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK
PERIOD FROM I-95 CORRIDOR TO BEAUREGARD ST/MARK CENTER
(without I-95/I-395 HOT Lanes)

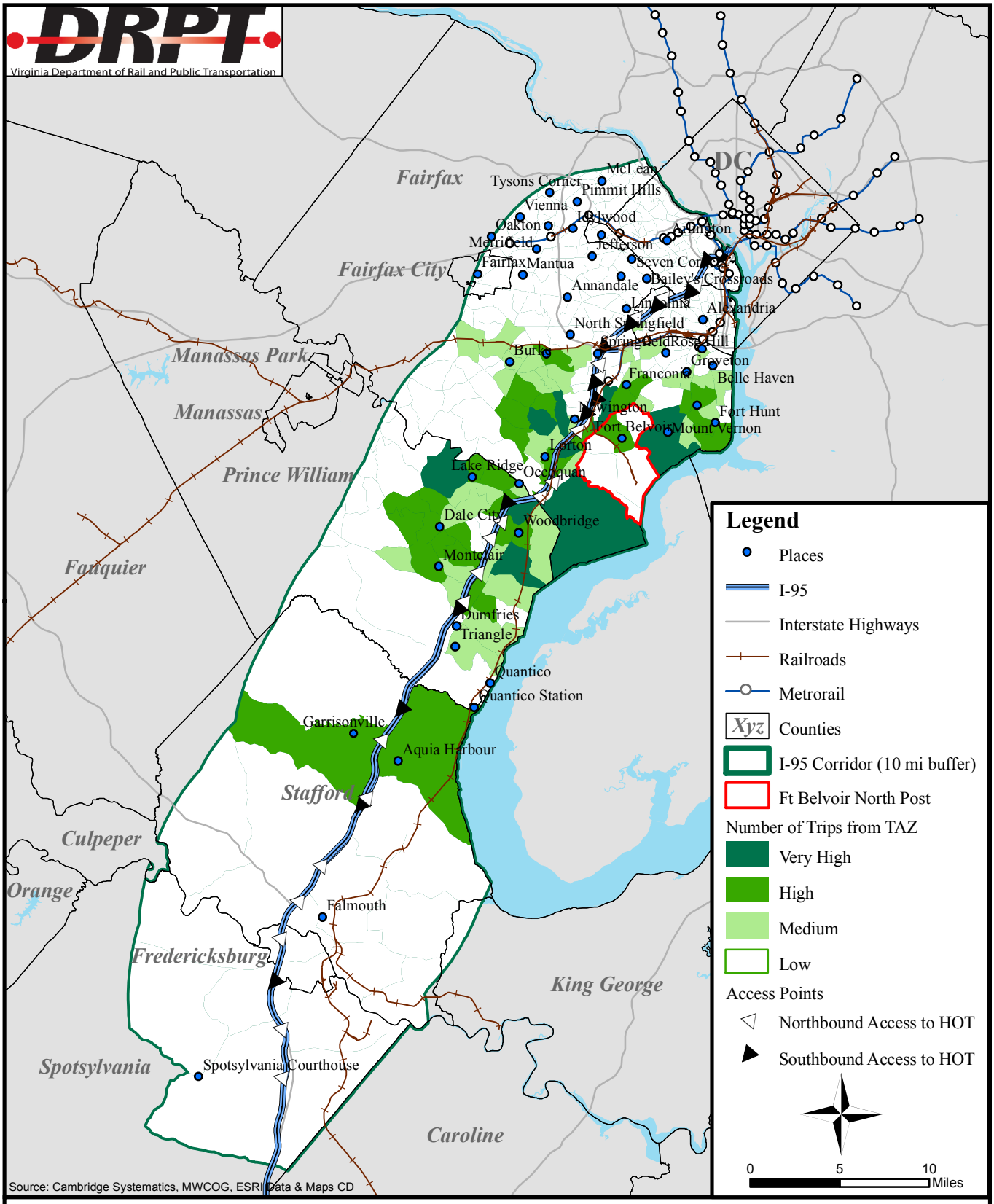



Figure 20

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM
PEAK PERIOD FROM I-95 CORRIDOR TO FORT BELVOIR NORTH POST
(without I-95/I-395 HOT Lanes)

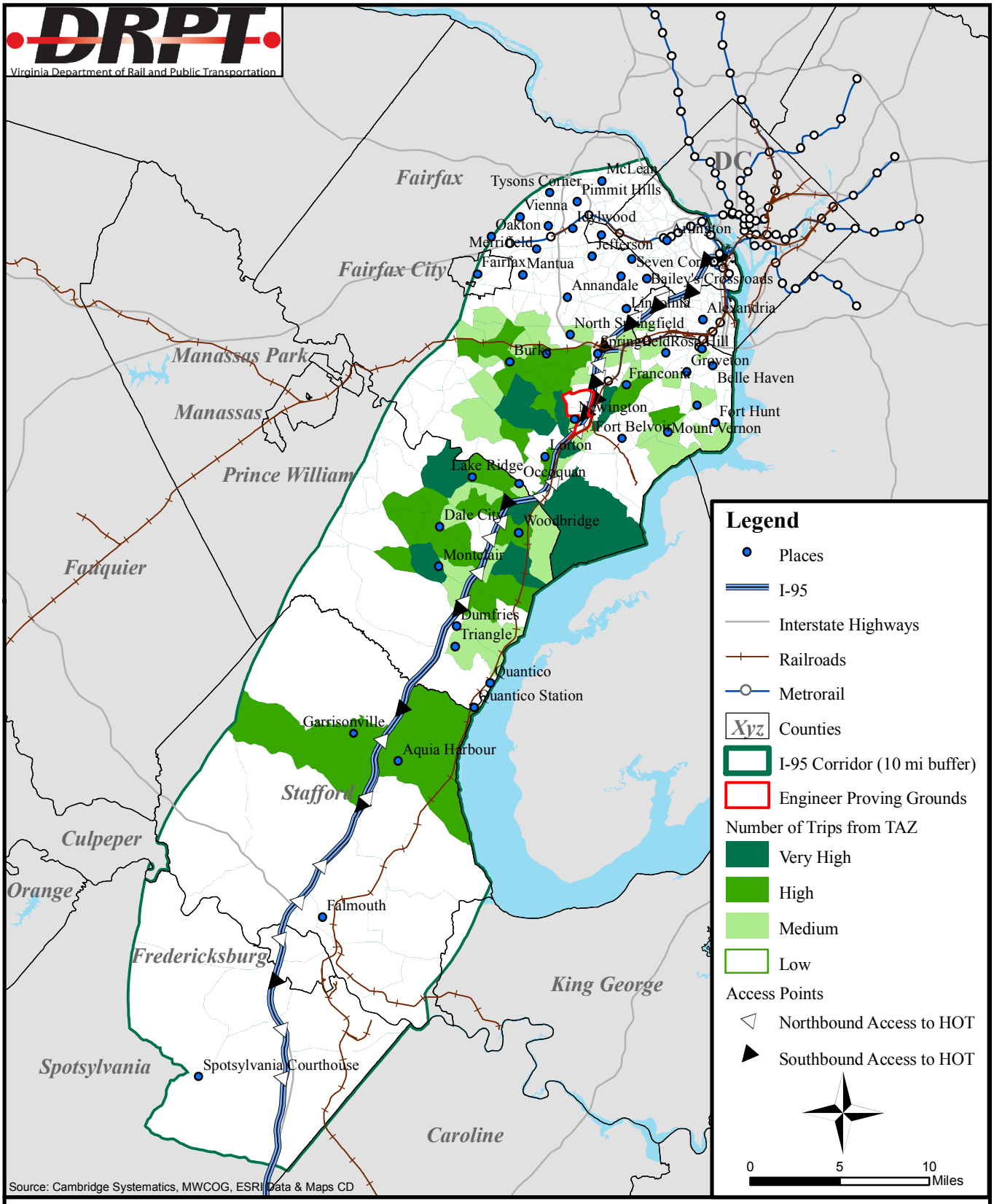



Figure 21

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK PERIOD
FROM I-95 CORRIDOR TO FORT BELVOIR ENGINEER PROVING GROUNDS
(without I-95/I-395 HOT Lanes)

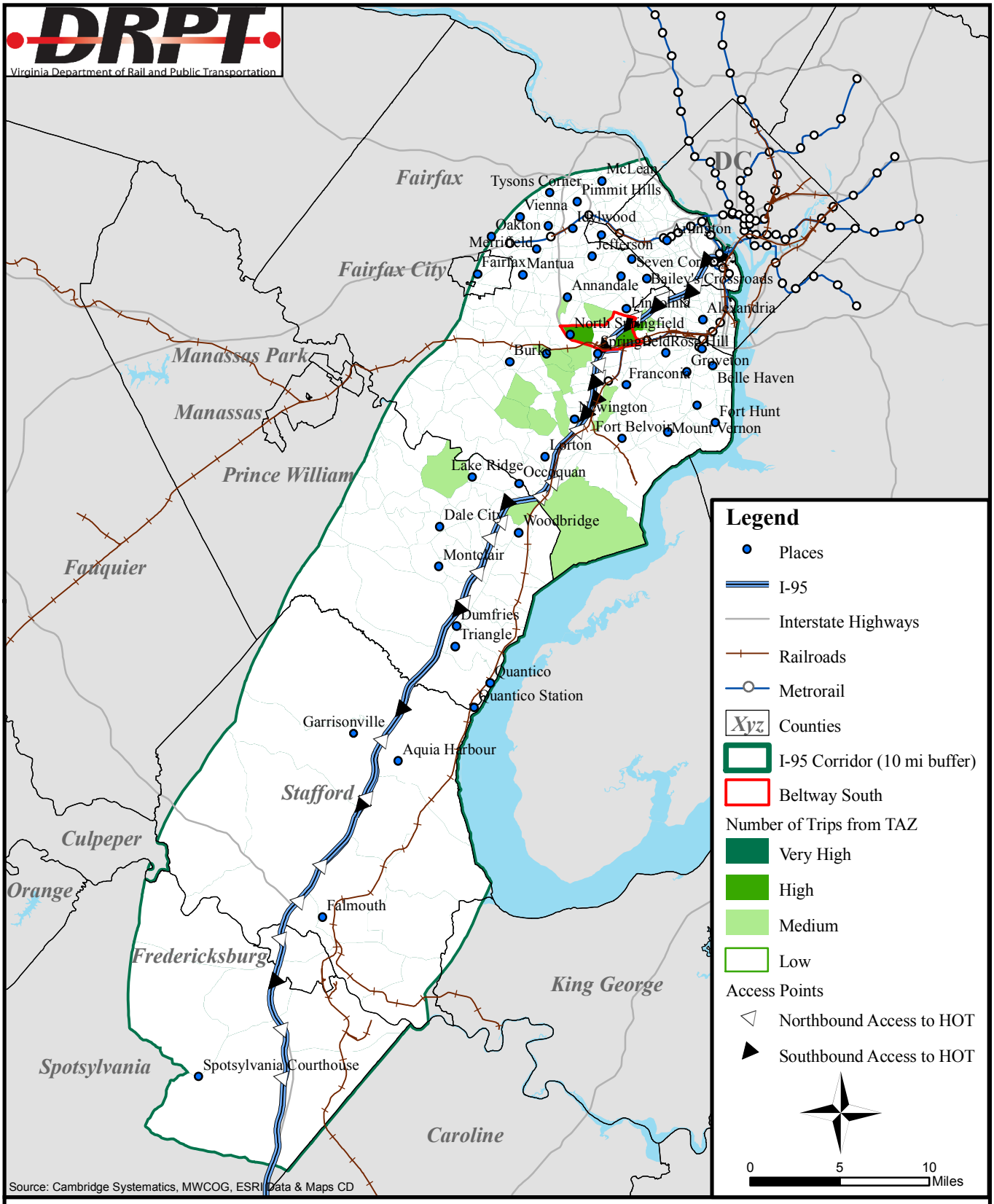



Figure 22

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO BELTWAY SOUTH
(without I-95/I-395 HOT Lanes)

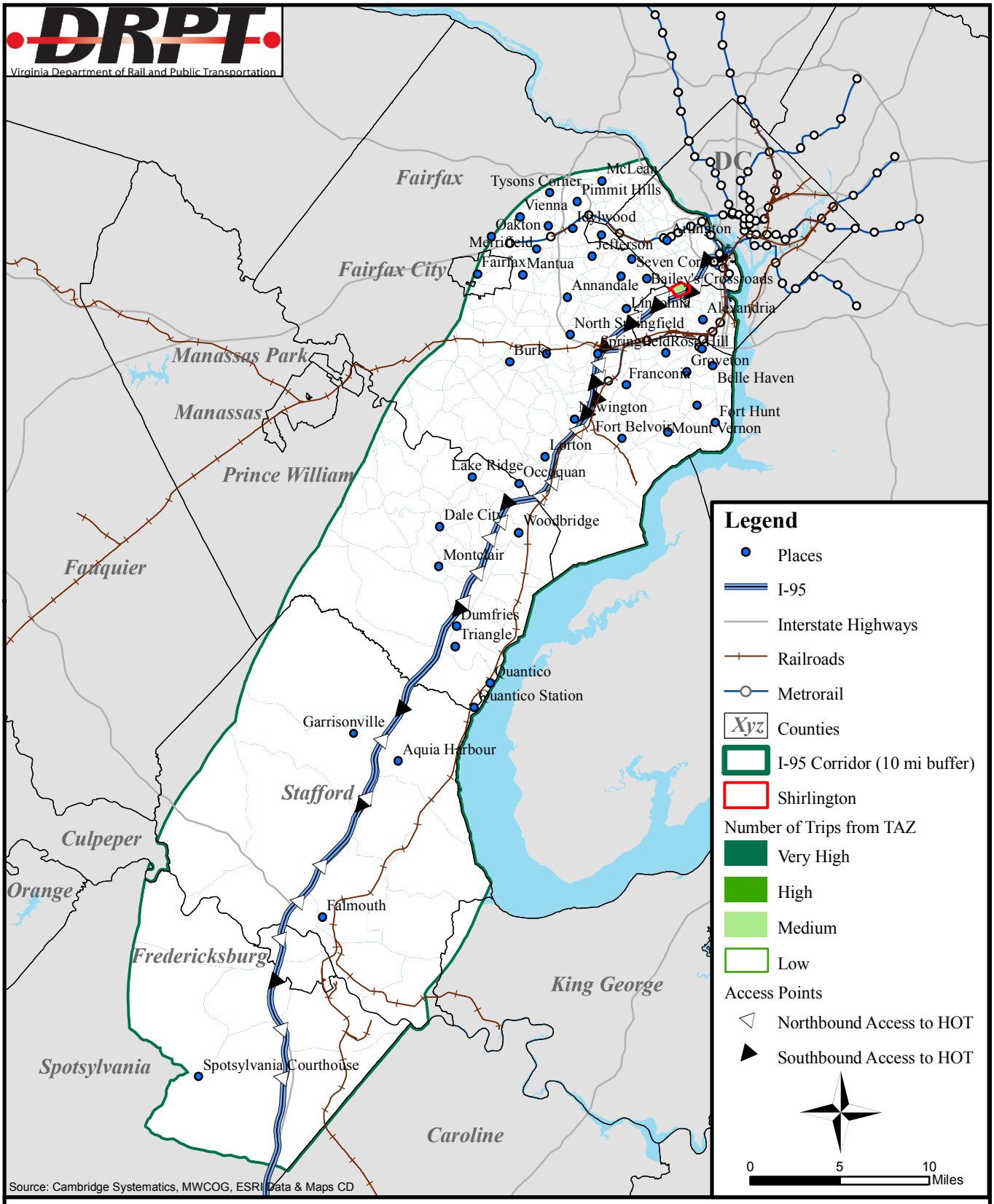



Figure 23

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO SHIRLINGTON
(without I-95/I-395 HOT Lanes)

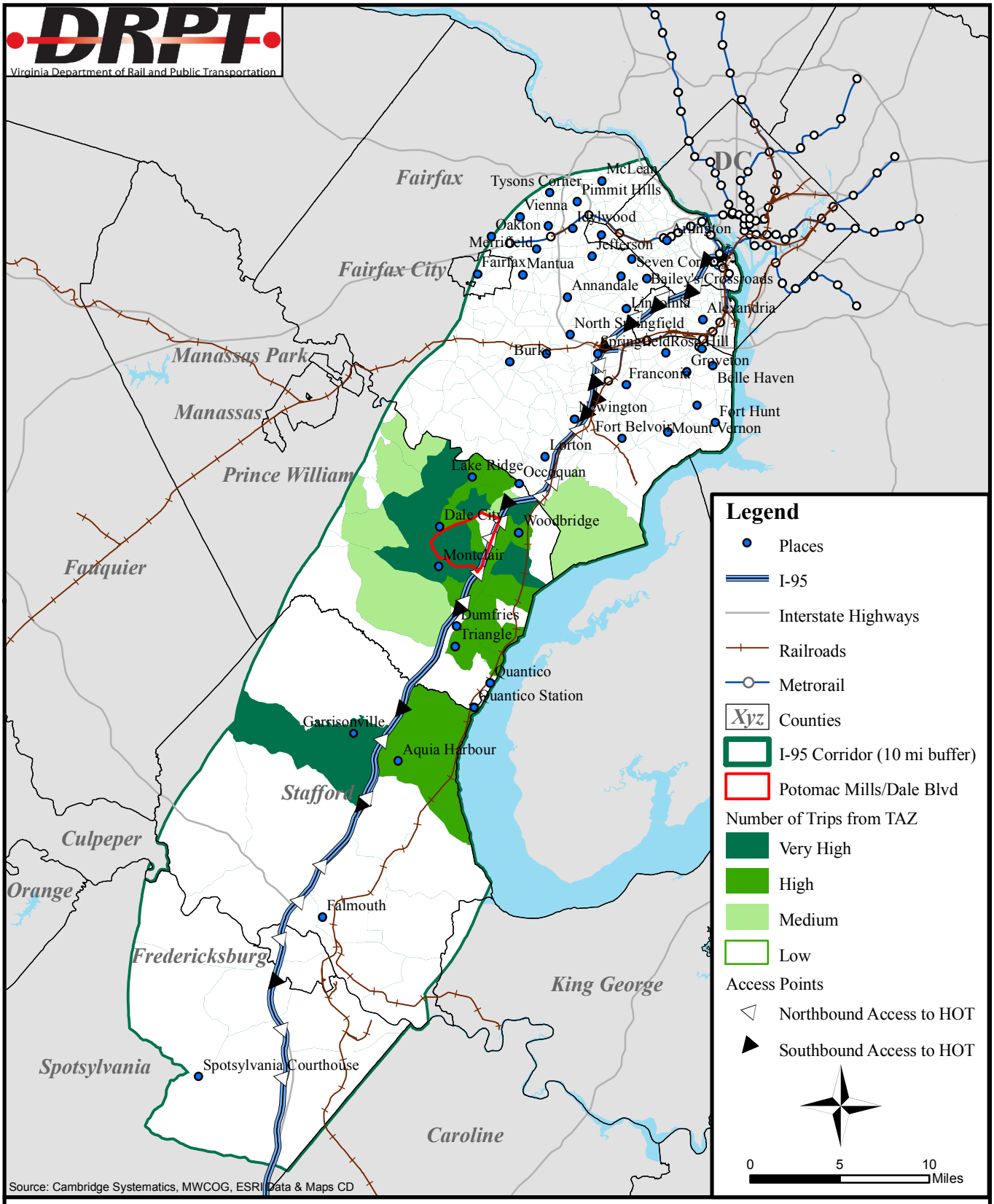



Figure 24

2015 PROJECTED HOME-BASED WORK TRIPS DURING AM PEAK PERIOD FROM I-95 CORRIDOR TO POTOMAC MILLS/DALE BLVD (without I-95/I-395 HOT Lanes)

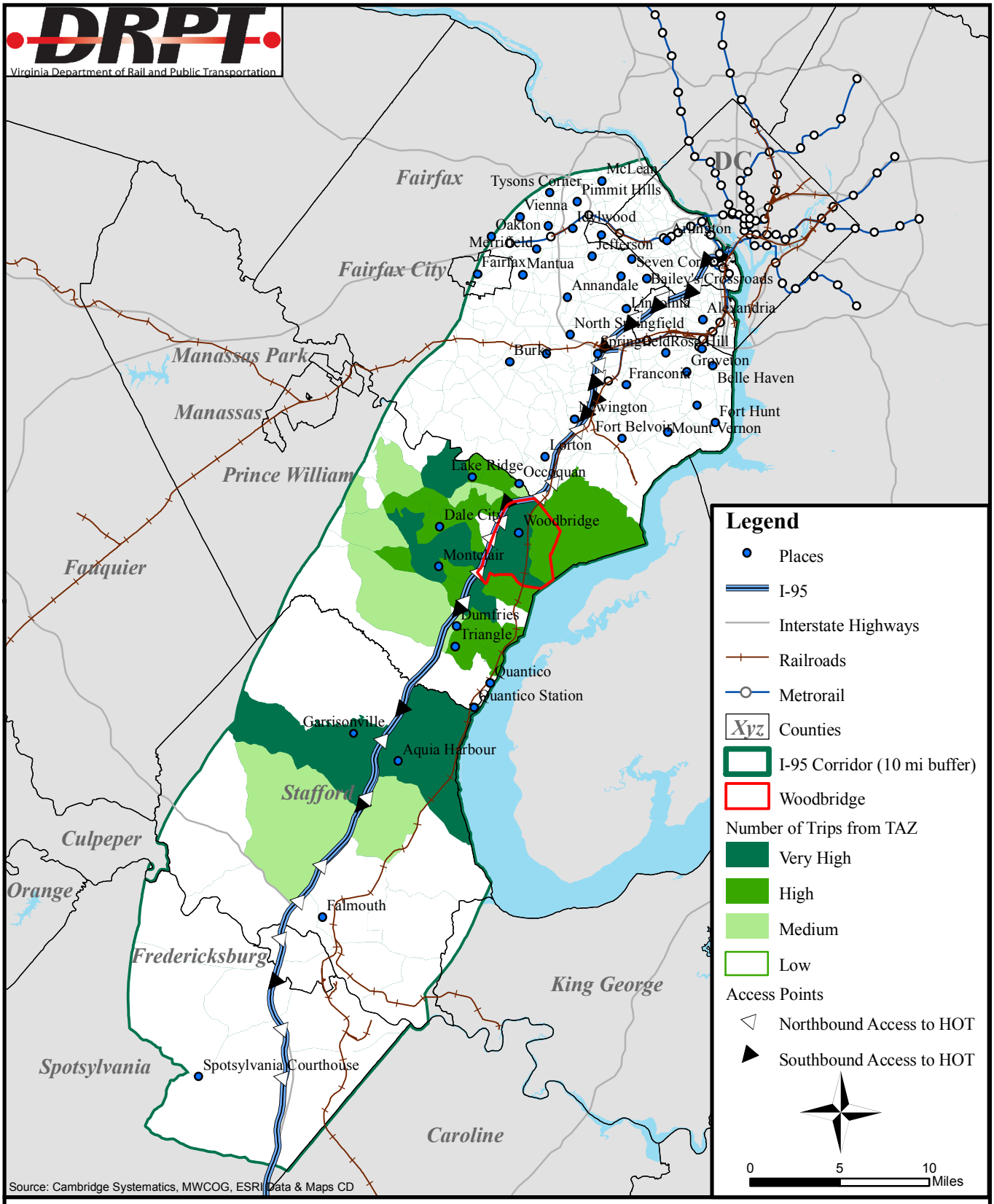



Figure 25

2015 PROJECTED HOME-BASED WORK TRIPS DURING
AM PEAK PERIOD FROM I-95 CORRIDOR TO WOODBRIDGE
(without I-95/I-395 HOT Lanes)

# Appendix C

# *I-95/I-395 HOT Lanes Transit/TDM Study*

November 29, 2007

DRPT
Virginia Department of Rail and Public Transportation
*The Smartest Distance Between Two Points*

# Study Purpose

*This research is part of a project that is designed to provide the Commonwealth and other transportation leaders and decision makers with recommendations on a comprehensive approach to the future provision of transit and transportation demand management (TDM) services and programs in the I-95/I-395 corridor. Southeastern Institute of Research and Cambridge Systematics are working with the Department of Rail and Public Transportation (DRPT), Virginia Department of Transportation (VDOT), and Transit/TDM Advisory Committee (TAC) to use these findings to develop a comprehensive alternative transportation plan to reduce congestion through the increased use of enhanced transit and TDM services in the corridor.*

# Objectives and Methodology

# Study Objectives

- Profile current travel patterns by modes on the I-95/I-395 corridor.
- Measure the current level of awareness, familiarity, and beliefs regarding high-occupancy toll (HOT) lanes.
- Assess the propensity of commuters to change their commute behavior in response to HOT Lanes availability.
- Identify the relative appeal of specific enhancements and programs (transit/TDM alternatives) needed to be in place to increase the likelihood of using non-single-occupant vehicle (SOV) modes.
- Assess the relative impact of alternatives to help calibrate subsequent modeling activities.

# Study Methodology

- An online survey was designed and conducted in order to meet the objectives of this research.
- The survey topics guide and survey instrument were developed with input from TAC members.
- The 20+ minute online survey was programmed and tested prior to launch. The survey questionnaire included elaborate skip patterns to accommodate multiple modes and origin/destination (O/D) patterns.
- Questionnaire included scaled attitude and opinion questions, open-ended questions, and "scenario testing" where additional HOT lanes price points and time savings scenarios were tested. These questions were designed for use by Cambridge Systematics in developing statistical demand projection models.
- A $5 Starbuck's gift card was offered to respondents as a "thank you" incentive.

# Study Methodology

- In order to qualify for this study, respondents had to commute along I-95/I-395 corridor
  - Their regular commute must occur during morning peak travel times
  - They must be headed north
  - They must reside in a predetermined study area defined by zip codes. Residents of the study area are most likely to be traveling in the I-95/I-395 corridor in the area of the HOT lanes.
- The sample consists of commuters across a variety of transportation modes:
  - SOV (gasoline engine and hybrid)
  - Formal carpool
  - Vanpool
  - Informal carpool (slug)
  - Commuter bus
  - Virginia Railway Express (VRE)/Metrorail

# Study Methodology

- A sample size quota of 200 was targeted for each transportation mode with the exception of SOV commuters. SOV sample quota was 500.

- Sample sizes of 200 and 500 have margins of error of +/- 6.9 percentage points and +/- 4.4 percentage points, respectively, at the 95% confidence level.

# Study Methodology

- Research respondents are classified according to their primary commute mode

- Mode classification is based on primary commute mode, using this question:

  Please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. In the table below, please enter the number of weekdays you typically use each of the listed types of transportation as your **primary** mode for your **morning** commute. If you use more than one type on a single day (e.g., walk to the bus stop, then ride the bus), please count only the type you use for the **longest distance part** of your commute trip. (If you do not use a particular form of transportation for your morning commute, please enter a 0 for that form of transportation.)

- For this analysis, mode of usage is further classified:

  - For those who commute 5 days a week, the mode they use 3 or more days is defined as the "primary" mode

  - For those who commute 3 or 4 days a week, the mode they use at least 2 days a week is defined as the "primary" mode

# Study Methodology

- Each commute mode is defined specifically
  - SOV: Commute in a single occupant vehicle
  - Carpool:
    - 2-person Carpool: Commute in a pre-arranged carpool with 1 other person either as the driver or as a passenger
    - Carpool 3+: Commute in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger
  - Vanpool: Commute in a vanpool
  - Slugger: Commute in an informal carpool – picking up or being picked up as passengers to use the HOV lanes
  - Bus: Ride a bus
    - In some parts of the analysis, commuters are also defined in terms of whether or not they ride an express bus. An express bus is defined in this way: "An express bus service is a motorcoach or bus, generally traveling longer distance with limited stops, taking commuters to their work areas." Respondents classified themselves as riding an express bus or not.
  - VRE: Ride the Virginia Railway Express
  - Metrorail: Ride Metrorail

# Study Methodology

- Each mode was targeted specifically in order to ensure representation in the survey sample
  - Residents (SOVers and other modes): Mailed 75,000 postcards announcing this study to residents living across the study area
  - Carpoolers: Emailed an online survey invitation and link to the Metropolitan Washington Council of Governments' (MWCOG) Guaranteed Ride Home (GRH) service database registrants who live in the study area. Mailed postcard invitations to other carpool lists
  - Vanpoolers: In addition to GRH database, reached vanpoolers by mail invitations to available lists of Virginia vanpool drivers who originate from the study area
  - Sluggers: Some slugs entered via resident postcard mailing and others through announcement on slug-lines.com
  - Bus: Emailed an online survey invitation to list provided by Potomac and Rappahannock Transportation Commission (PRTC). Other bus riders participated via postcard mailing
  - VRE: Posted survey invitation in VRE's electronic newsletter

# Study Methodology

## Number of Qualified Respondents for Each Commute Mode: Primary Commute Mode

| Mode Group | Quota Target | Number of completed Interviews |
|---|---|---|
| **SOV** | 500 | |
| Drive alone (gas-powered) | | 816 |
| Drive alone (hybrid) | | 100 |
| **Total carpool** | | |
| Formal carpool | 200 | 356 |
| Slug | 200 | 606 |
| **Vanpool** | 200 | 268 |
| **Bus** | 200 | 389 |
| **Train** | 200 | 686 |
| **Other** | 0 | 67 |
| **Total** | **1,500** | **3,288** |

**Formal carpool:**
**2-person n = 126**
**3 or more n = 230**

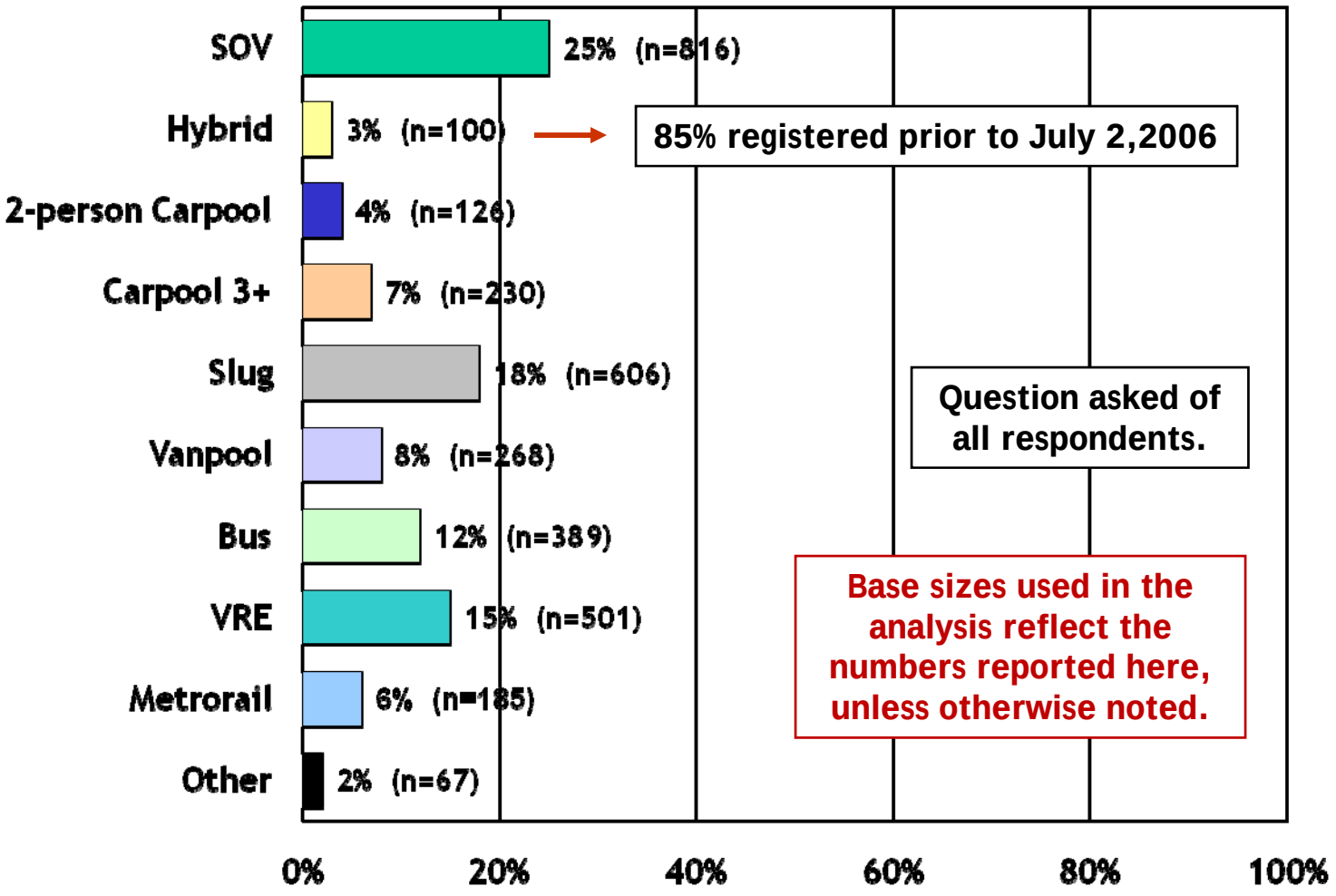
**Train:**
**VRE n = 501**
**Metrorail n = 185**



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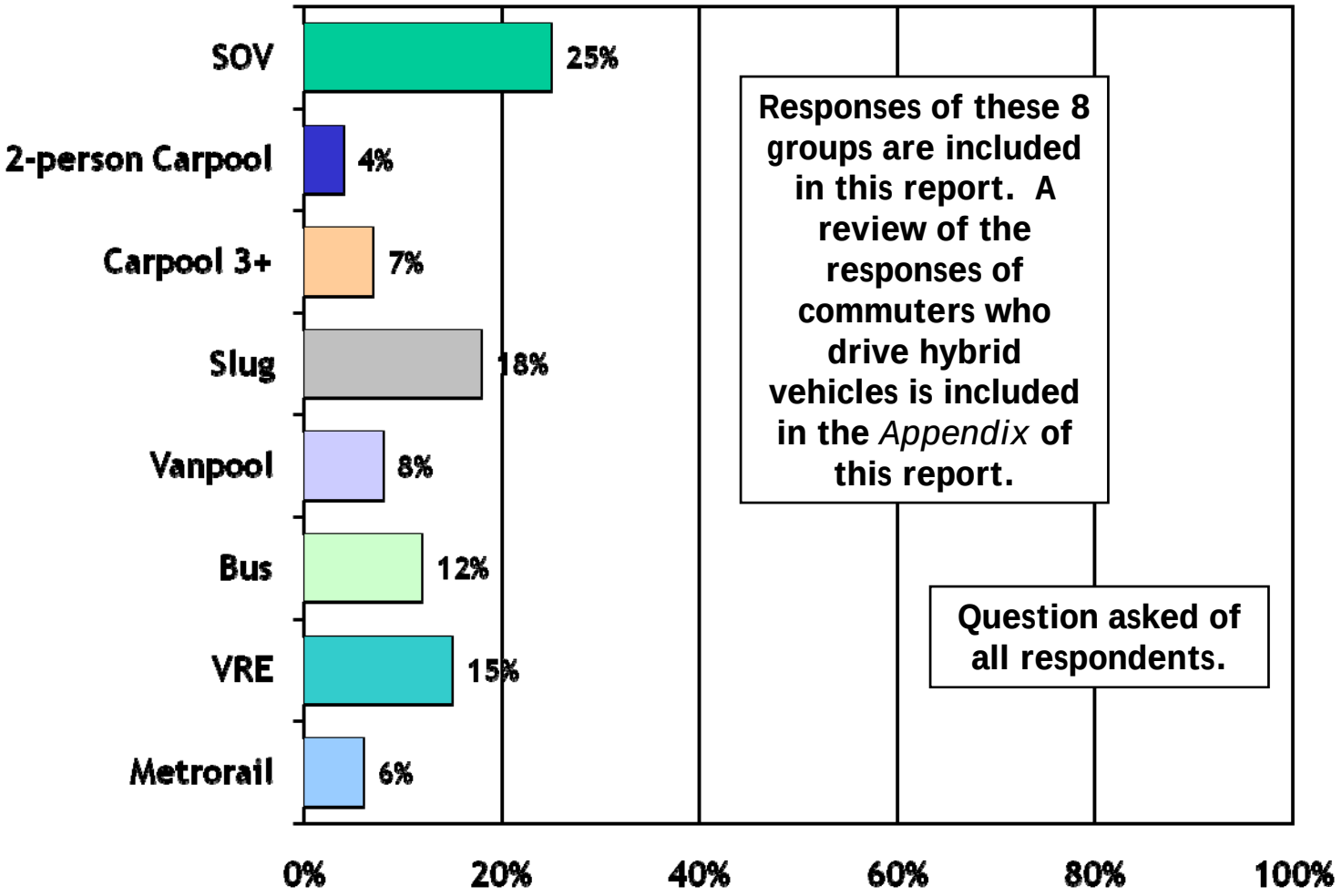
# Mode Distribution by Proportion of Sample

Q6. Please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. In the table below, please enter the number of weekdays you typically use each of the listed types of transportation as your primary mode for your morning commute.



# Focus of Report

Q6. Please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. In the table below, please enter the number of weekdays you typically use each of the listed types of transportation as your primary mode for your morning commute.






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# Detailed Observations

# Outline of Report

## *I. Profile of Commuters*

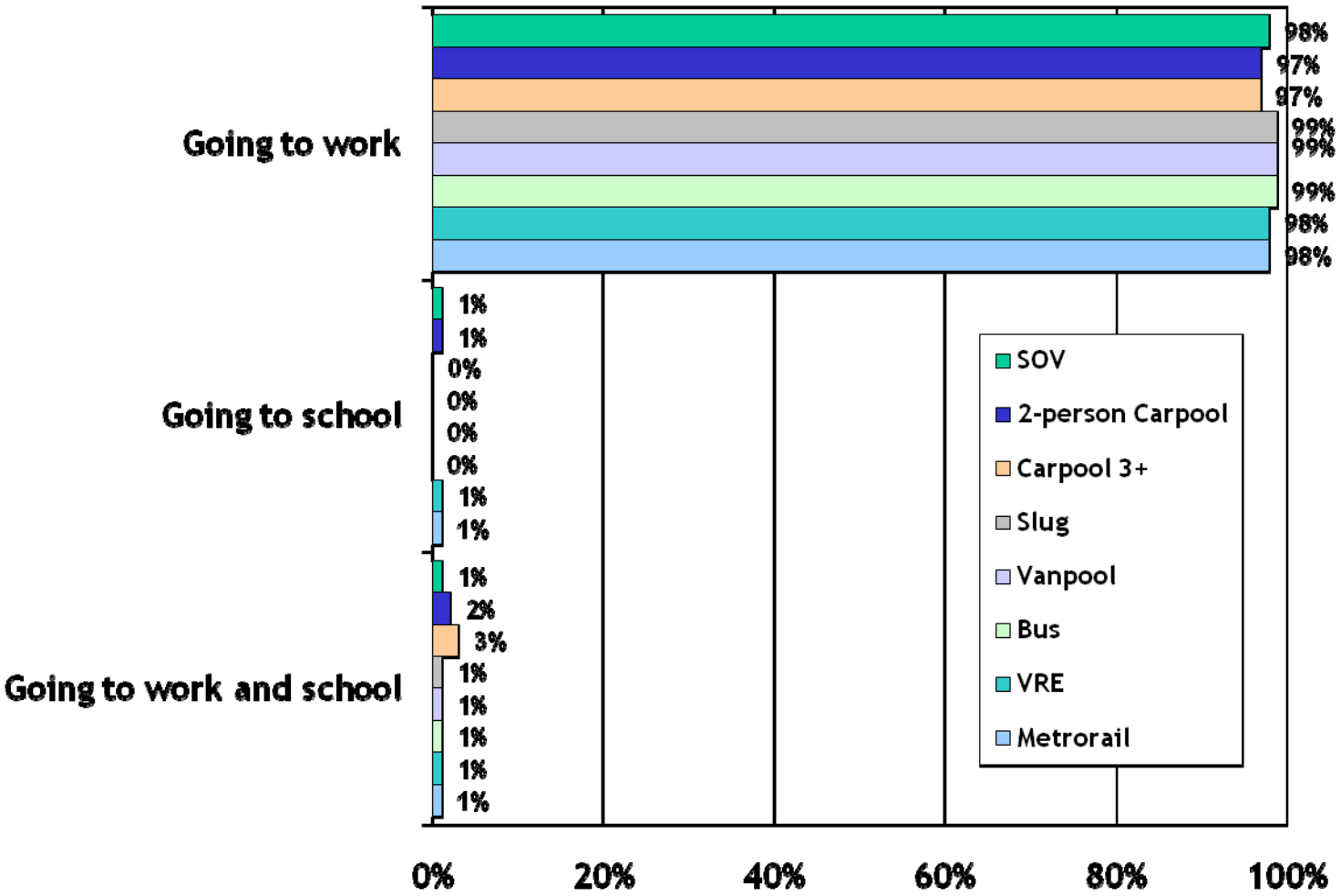
- Commute patterns and behaviors
- Attitudes that influence choices
- HOV lanes

## *II. HOT Lanes*

## *III. Transit and TDM Improvements*

# Typically, Commuters Are Going to Work

**Question asked of all respondents.**




Q3. What is the main purpose of your morning travel in the I-95/I-395 corridor?

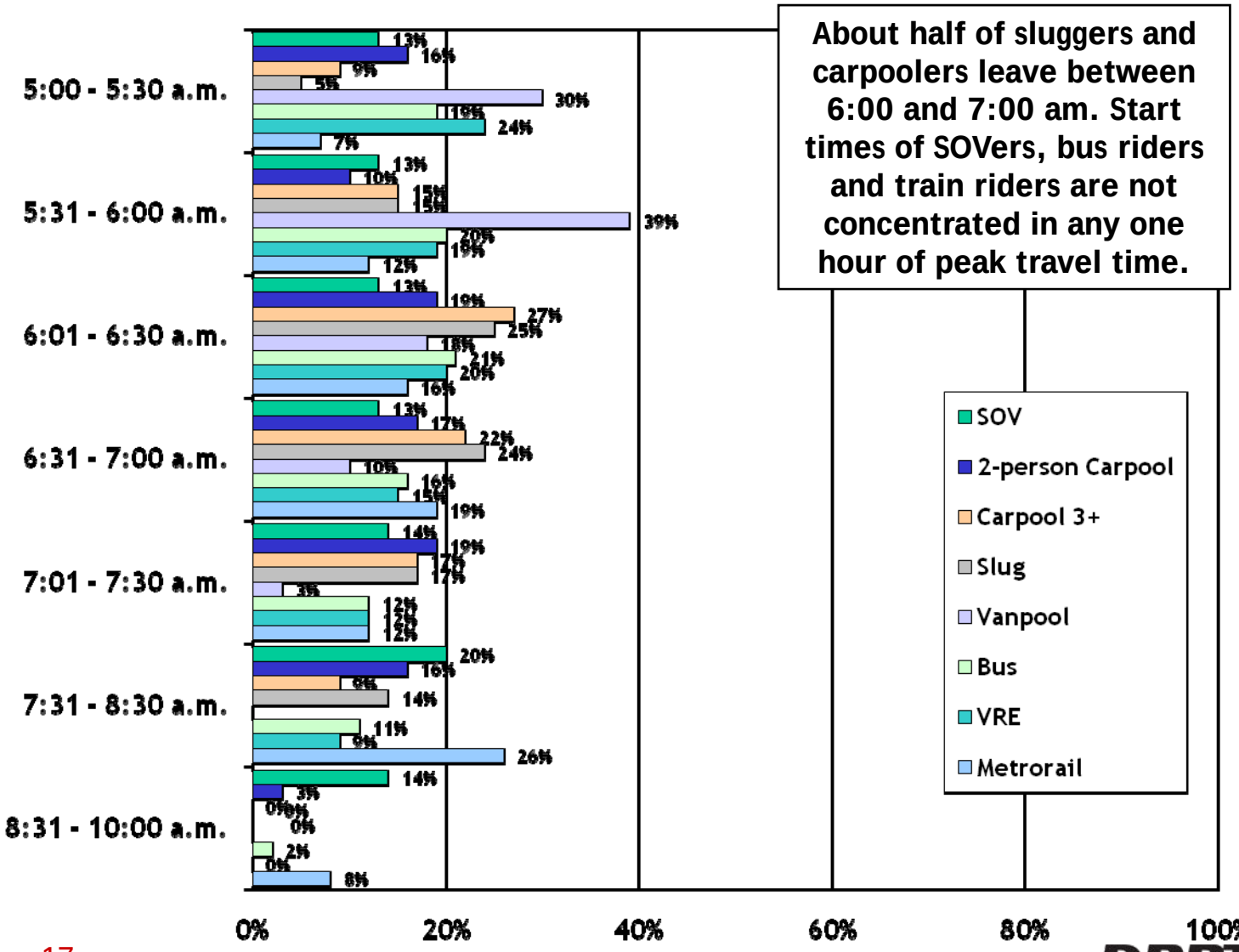


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# Vanpoolers Have the Earliest Commutes – 69% of Vanpoolers Leave between 5:00 and 6:00 a.m.

**Question asked of all respondents.**

Q5. About what time do you typically begin your commute (i.e., leave your house) in the I-95/I-395 corridor in the morning?



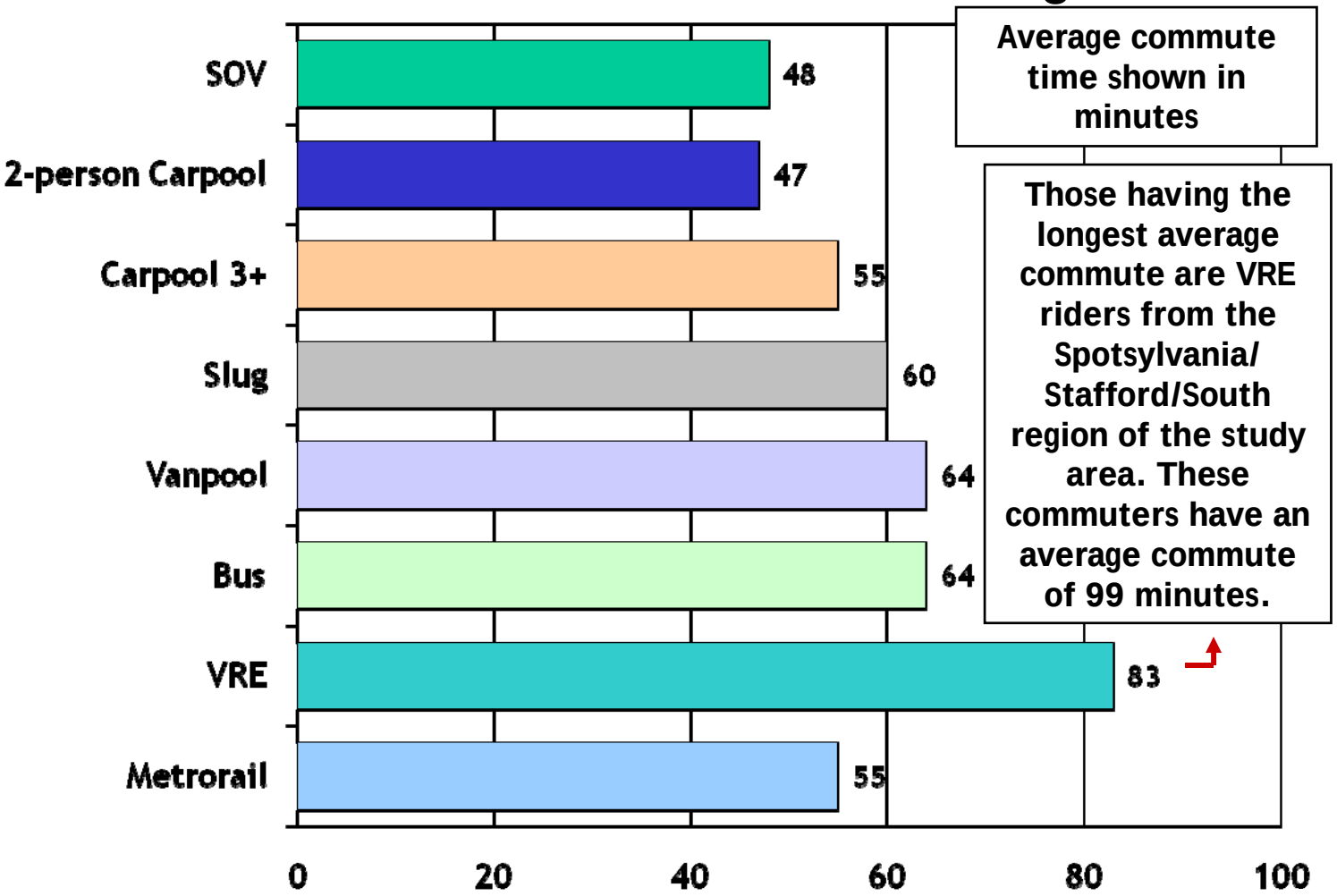

**About half of sluggers and carpoolers leave between 6:00 and 7:00 am. Start times of SOVers, bus riders and train riders are not concentrated in any one hour of peak travel time.**



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# VRE Riders Have the Longest Commutes – SOVers and 2-Person Carpools Spend the Least Time Commuting

**Question asked of all respondents.**




Q17. On average, how many **minutes** long is your total commute, door to door?

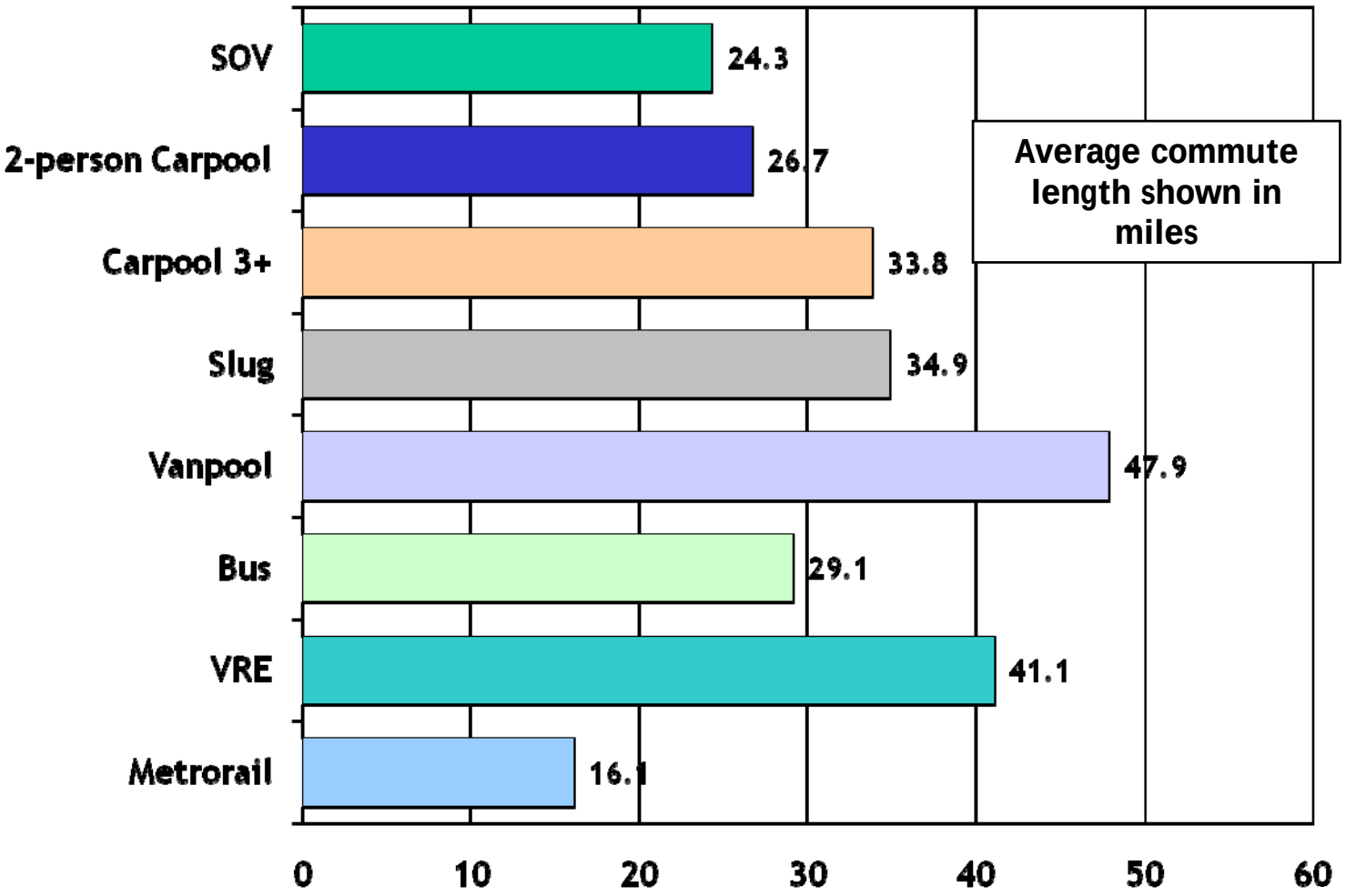


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# Vanpoolers Have the Longest Commute in Terms of Miles – Metrorail Riders Have the Shortest

**Carpoolers in 3+ carpools, sluggers, vanpoolers, VRE riders and bus riders from Spotsylvania/ Stafford/ South locations in the study area all commute an average of more than 50 miles on their morning commute.**

**Question asked of all respondents.**



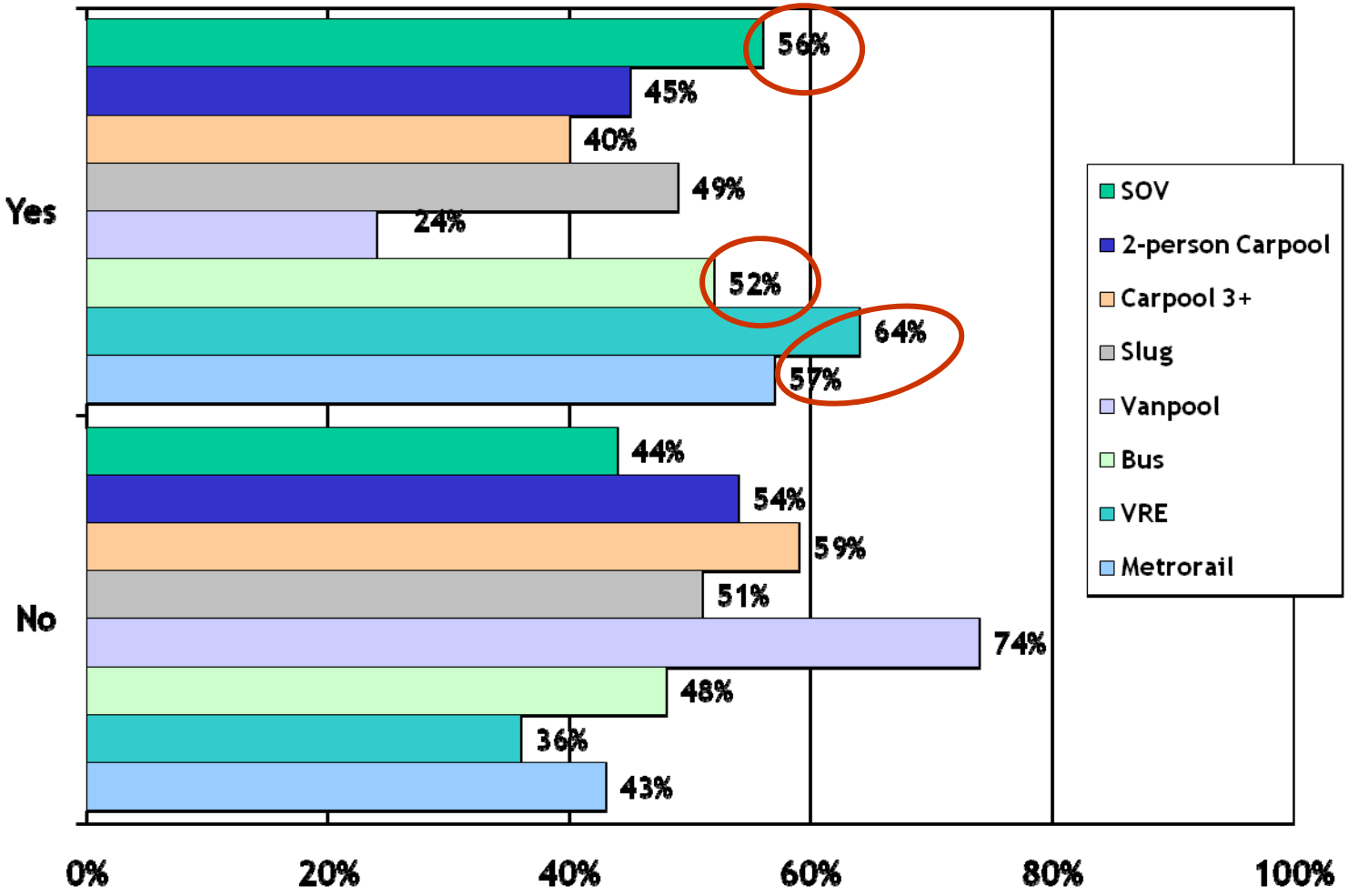

Q18. About how many **miles** long is your total morning commute, door to door?



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# Train Riders, SOVers, and Bus Riders Are Most Likely to Have Flexibility in their Schedules

**Question asked of all respondents.**



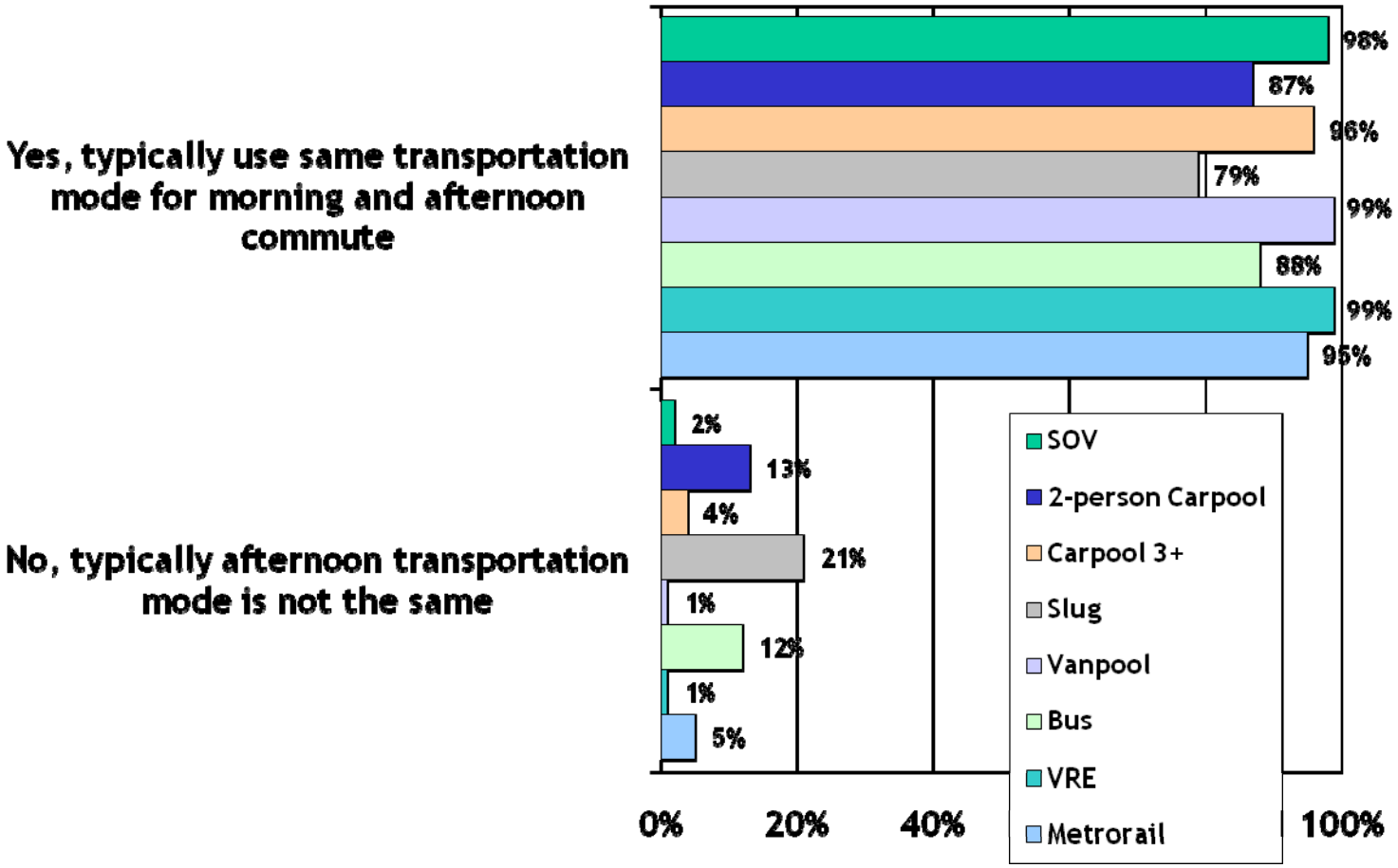

Q5a. Do you have flexibility in your daily departure time (that is, can you vary your arrival time at work/school)?



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# Sluggers Are Most Likely to Use a Different Mode of Transportation for their Afternoon Commute

**Question asked of all respondents.**




Q19. Again, please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. Do you typically use the same mode of transportation for your **afternoon** commute as you do for your **morning** commute?



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n=123

# Most Often, Morning Sluggers Who Do Not Slug Home in the Afternoon Use an Alternate Mode Because Slug Lines Are Not Available or Convenient in the Afternoon

**Some find that riding the bus is less stressful than slugging.**

**Due to small base size for SOVers, carpoolers, vanpoolers and train riders, responses to this question shown only for sluggers (this page) and bus riders (following page).**

| *Sluggers who use different transportation for afternoon commute* | |
|---|---|
| Lack of slug lines in afternoon | 30% |
| Bus less stressful than slugging | 14% |
| Slug lines not available near work | 11% |
| Rely on a combination of methods | 11% |
| Evening bus works well | 8% |
| Work schedule | 7% |
| Drive home after 6:00 p.m. so don't need slugs | 7% |
| Bus often late in mornings | 6% |
| Take bus or slug, whichever is available first | 5% |
| Carpool scheduling issues | 4% |

Note: Only most frequent mentions are shown.

Q27. Earlier, you indicated that you use a different commute mode(s) in the afternoons than you do in the mornings. Why do you use a different commute mode(s) in the afternoon?

n=44

# Bus Riders Use a Different Mode of Transportation in the Afternoons to Save Time and/or Money

| *Bus riders who use different transportation for afternoon commute* | |
|---|---|
| Saves time | 23% |
| Saves money | 20% |
| Take bus or slug, whichever is available first | 14% |
| Flexibility | 11% |
| Rely on a combination of methods | 9% |
| Convenience | 9% |
| Work schedule | 9% |
| Carpool scheduling issues | 7% |
| Lack of slug lines in evening | 7% |
| Ride with spouse one-way | 5% |

Note: Only most frequent mentions are shown.

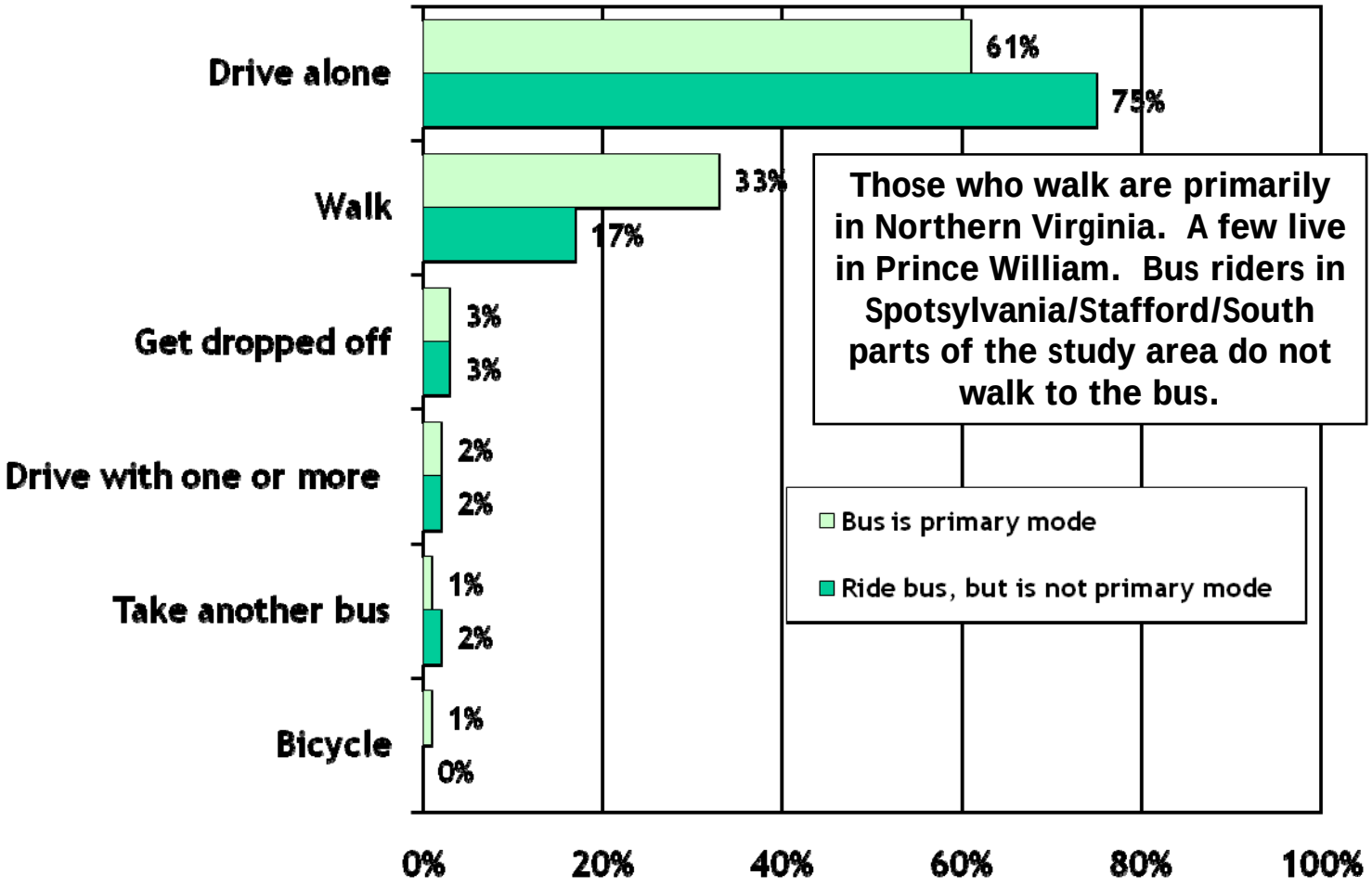
**Due to small base size for SOVers, carpoolers, vanpoolers and train riders, responses to this question shown only for sluggers (previous page) and bus riders (this page).**

Q27. Earlier, you indicated that you use a different commute mode(s) in the afternoons than you do in the mornings. Why do you use a different commute mode(s) in the afternoon?

Bus is primary mode, n=389
Ride bus, but is not primary mode, n=129

**Question asked of all who ride bus.**

# Most Often, Bus Riders Drive Alone to the Bus – A Few Walk



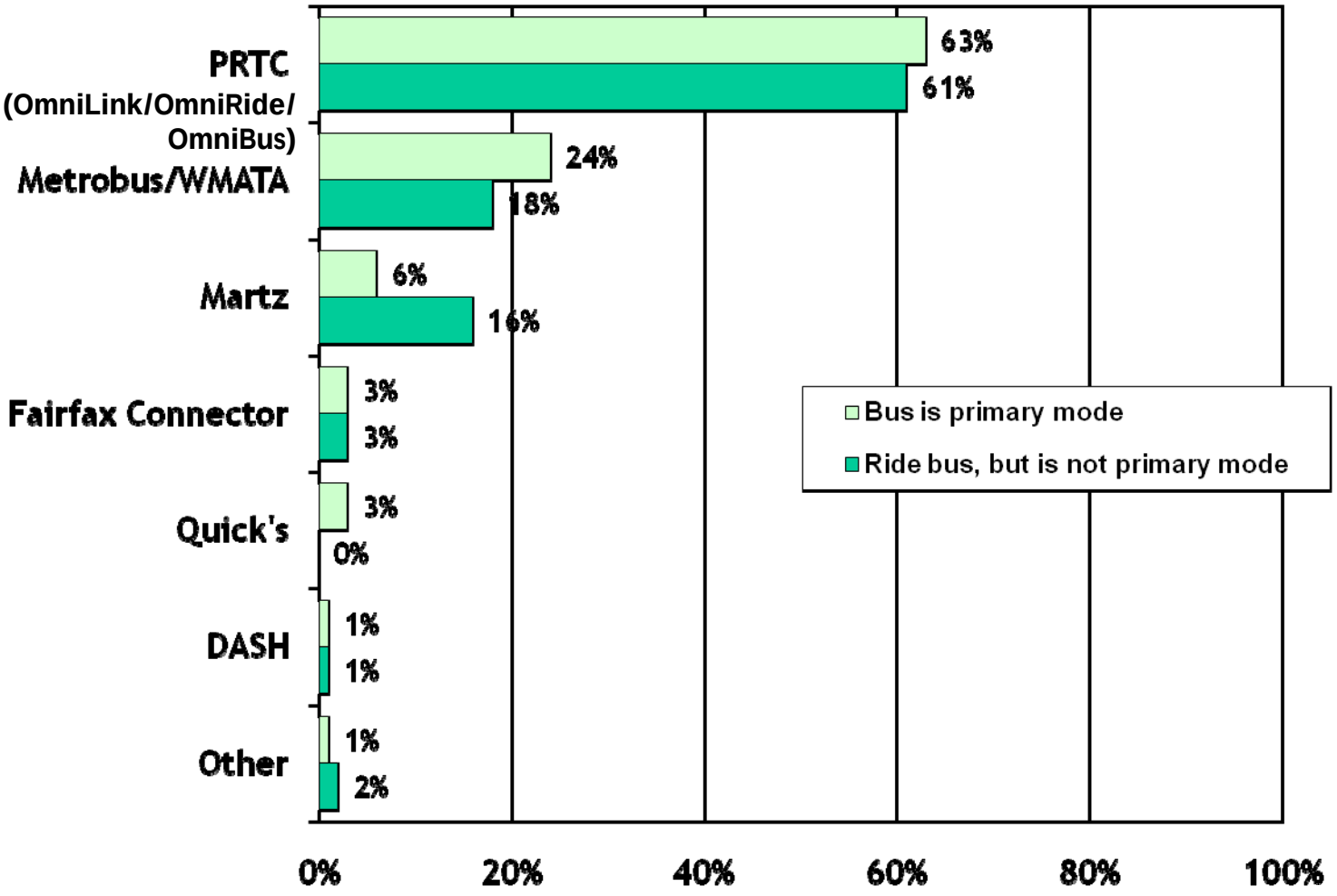

Q8. How do you get to the bus service that you use for your morning commute?



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Bus is primary mode, n=389
Ride bus, but is not primary mode, n=129

# Predominantly, Bus Riders in the Study Ride PRTC Buses – Both Those for Whom Bus Is Their Primary Mode as well as Other Bus Riders




Q7. Please identify the specific bus line that you use for your morning commute.



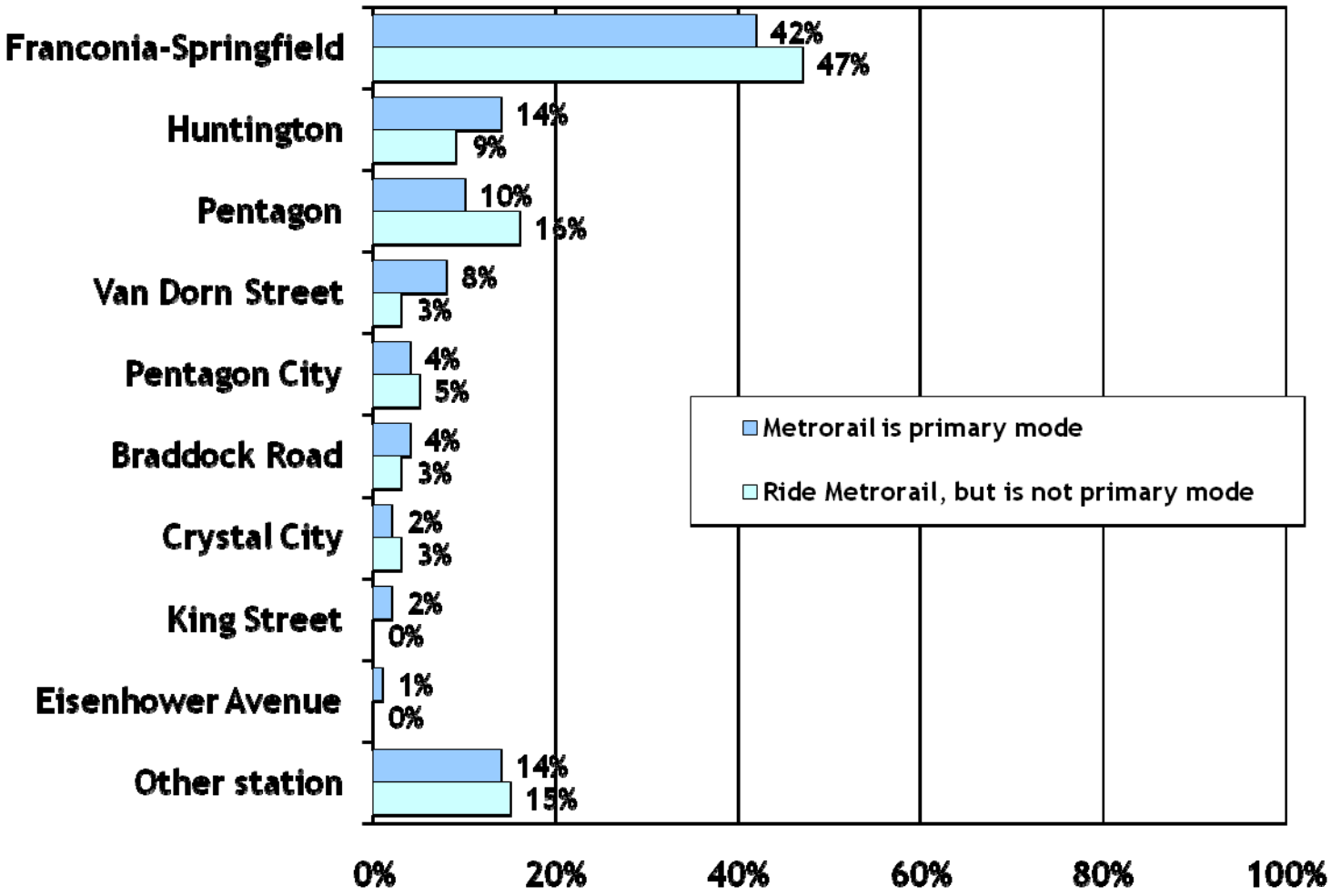
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Metrorail is primary mode, n=185
Ride Metrorail but is not primary mode, n=75

**Question asked of all who ride Metrorail.**

Q7A-1. At what Metrorail station do you typically begin the rail portion of your commute?

# The Largest Proportion of Metrorail Respondents Begin Their Metrorail Trip at Franconia-Springfield – But, Other Stations Are Also Represented





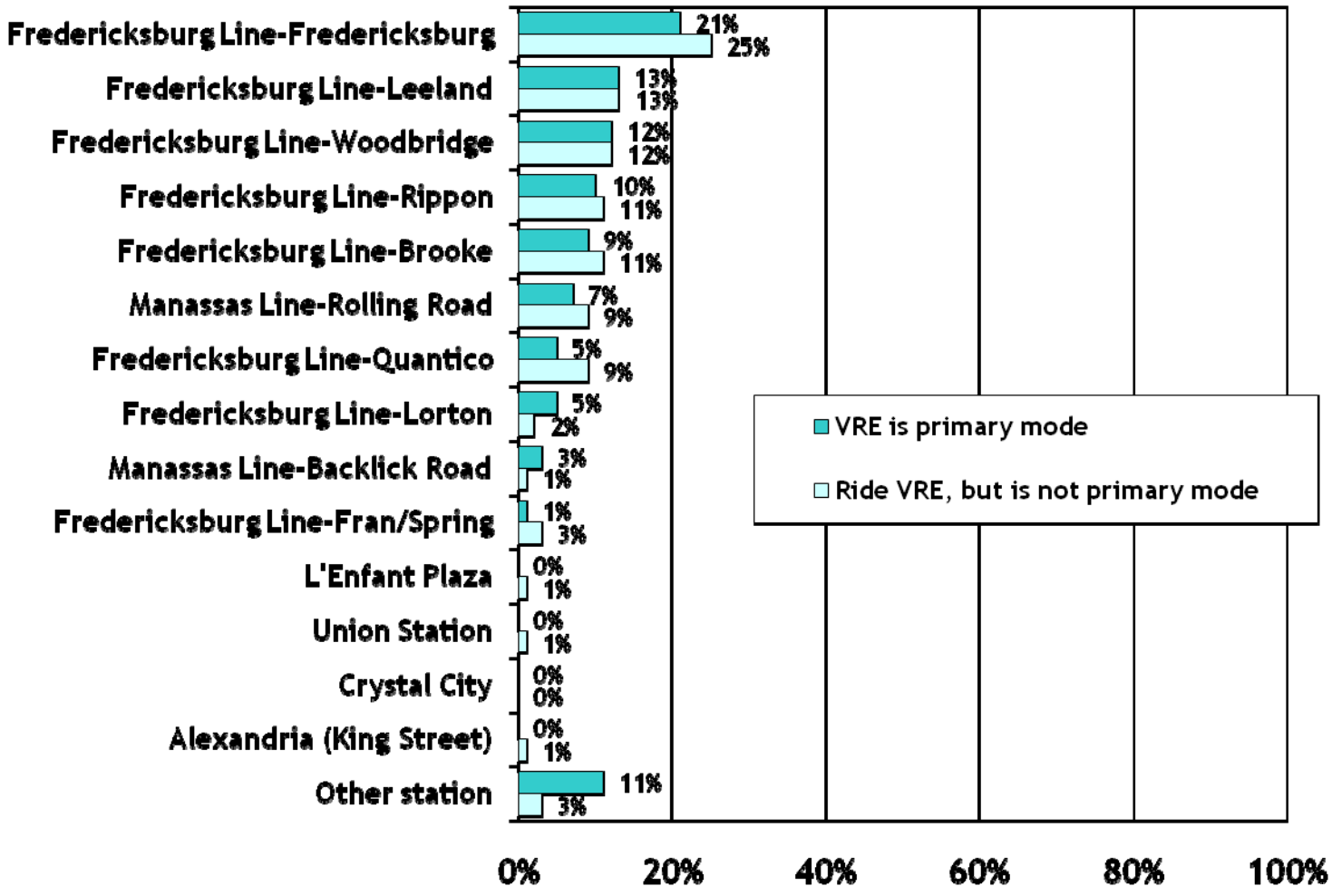

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VRE is primary mode, n=501
Ride VRE, but is not primary mode, n=92

**Question asked of all who ride VRE/train.**

Q7B-1. At what train station do you typically begin the rail portion of your commute?

# VRE Respondents Start Their Rail Trips at a Variety of Locations – Most Often at Fredericksburg





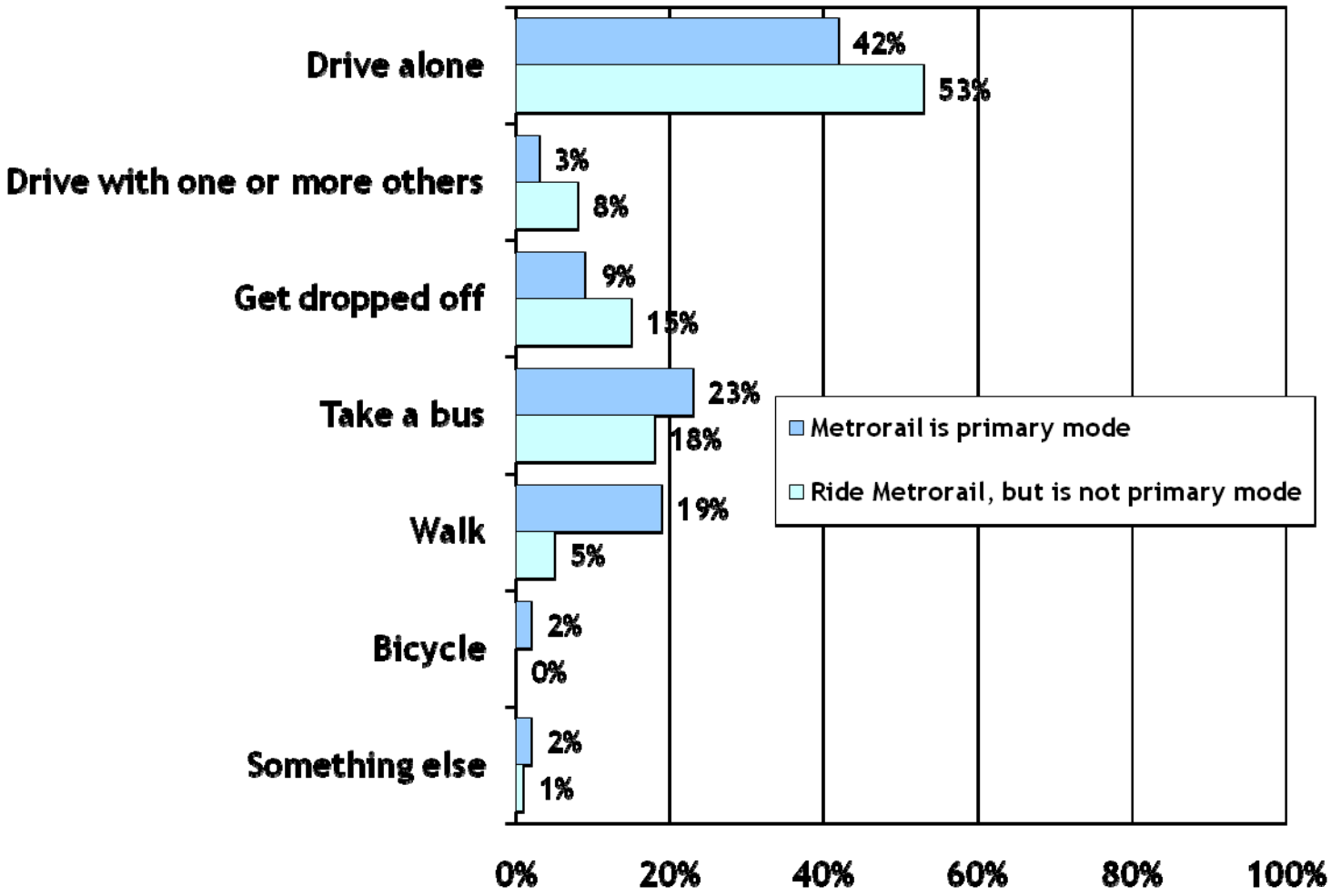

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Metrorail is primary mode, n=185
Ride Metrorail, but is not primary mode, n=75

**Question asked of all who ride Metrorail.**

Q8A-1. How do you get to the train (Metrorail) for your morning commute?

# About Half of Those Who Ride Metrorail Drive to the Train





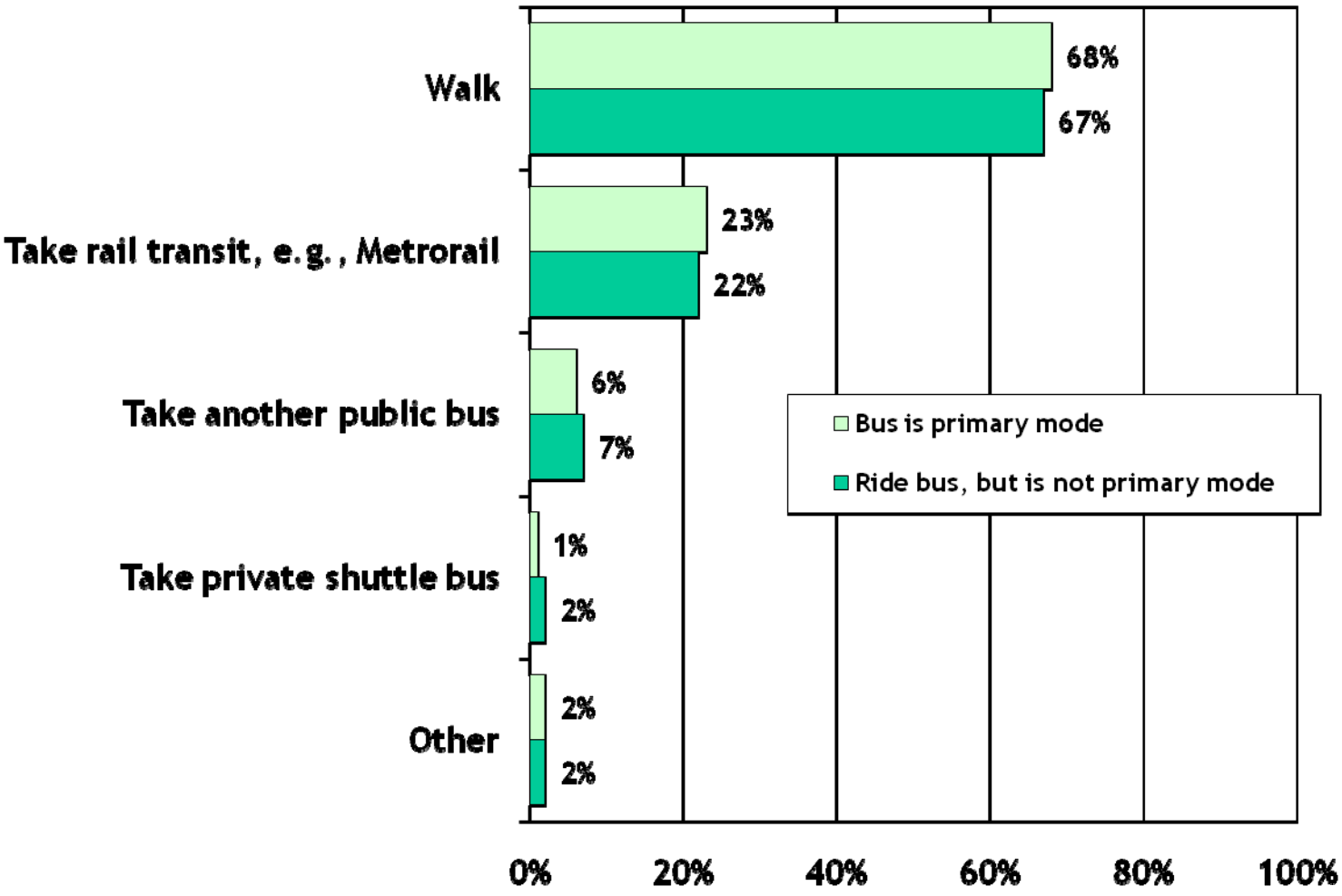

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Bus is primary mode, n=389
Ride bus, but is not primary mode, n=129

**Question asked of all who ride bus.**

Q8B-1. How do you typically get from the bus drop-off to the final destination of your morning commute (if more than one method used, please indicate the one you use for the longest distance)?

# Most Often, Bus Riders Walk from the Drop-off Point

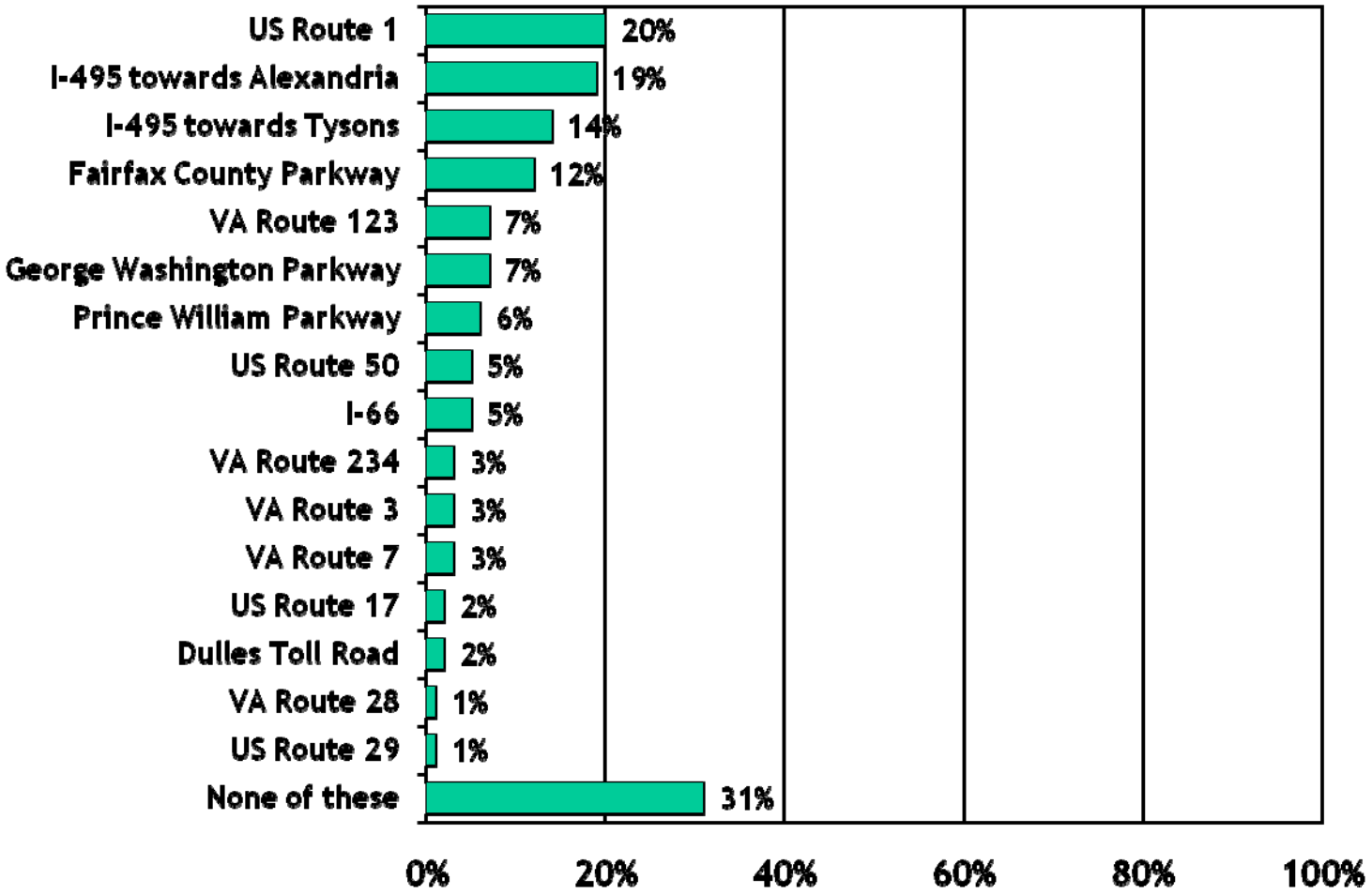





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# In Addition to I-95/I-395, SOVers Are Most Often Traveling US Route 1, I-495, and Fairfax County Parkway

**Question asked of all respondents. Only SOVers reported in graph.**



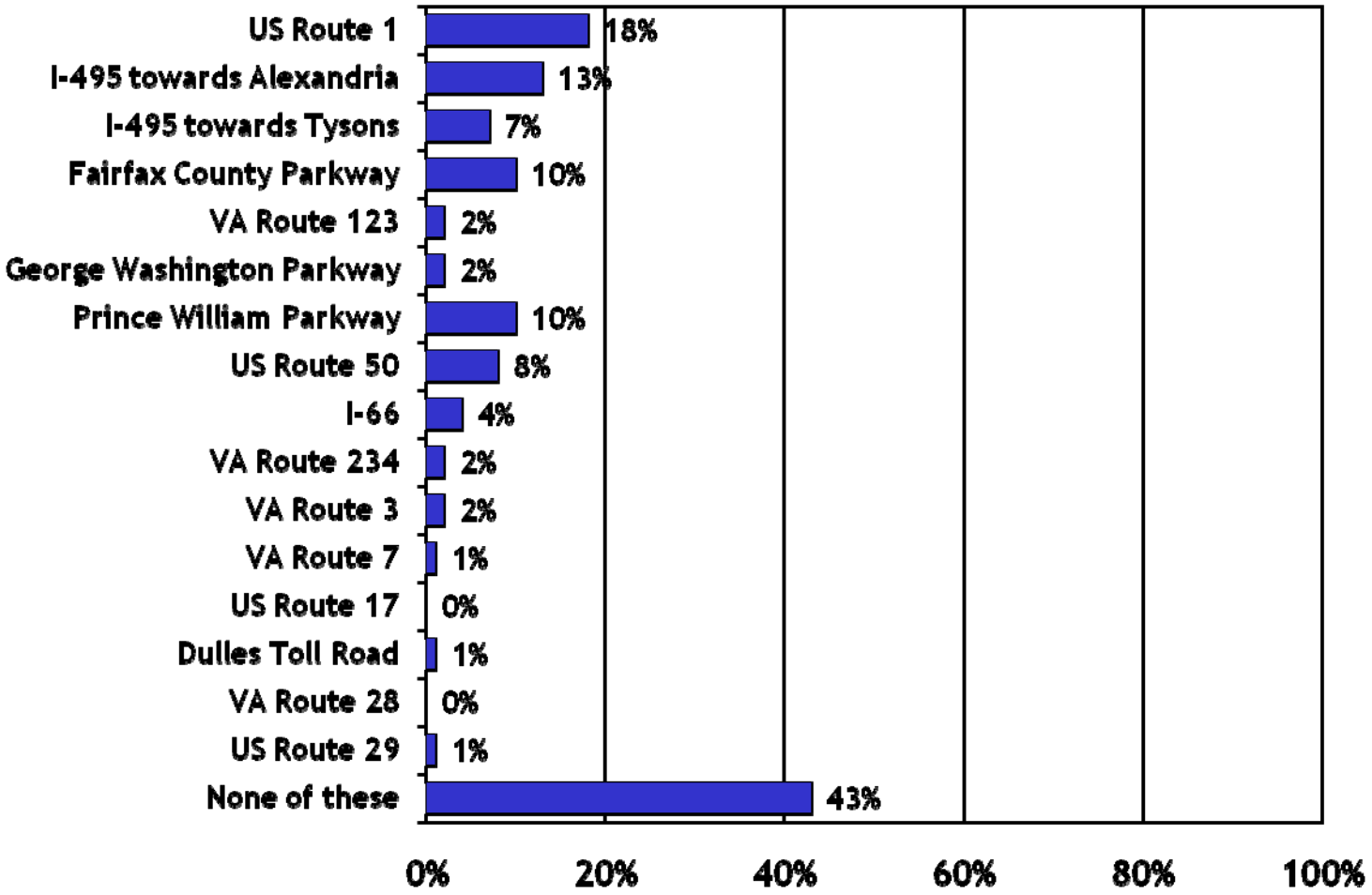

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# Nearly Half – 43% – of 2-Person Carpools Do Not Travel Any of the Other Roadways Listed

**Question asked of all respondents. Only carpools of 2 persons are reported in graph.**



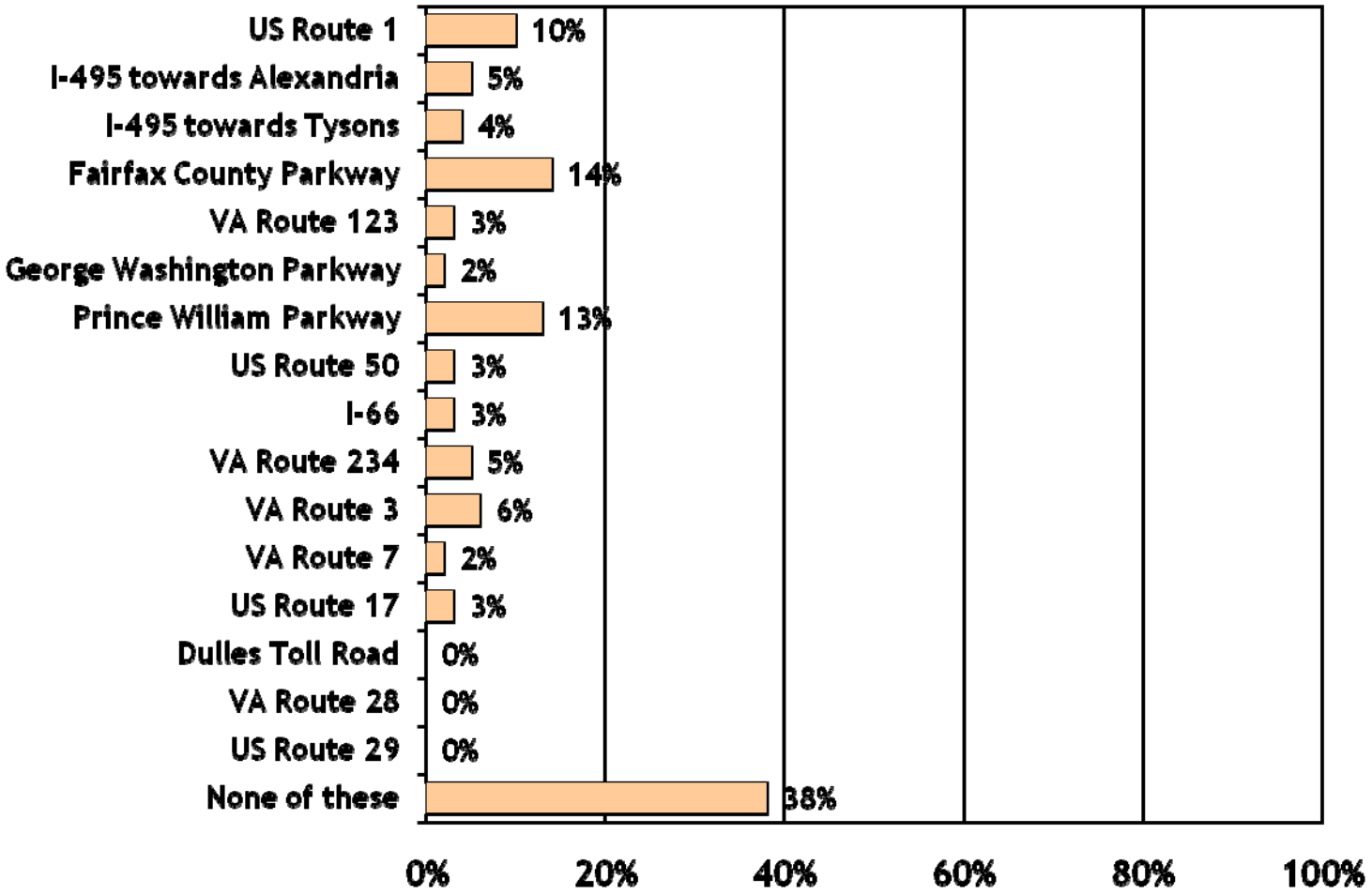

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# In Addition to I-95/I-395, Carpoolers in Carpools of 3 or More Are Most Likely to Travel on Fairfax County Parkway, US Route 1, and Prince William Parkway

**Question asked of all respondents. Only carpools of 3 or more persons reported in graph.**



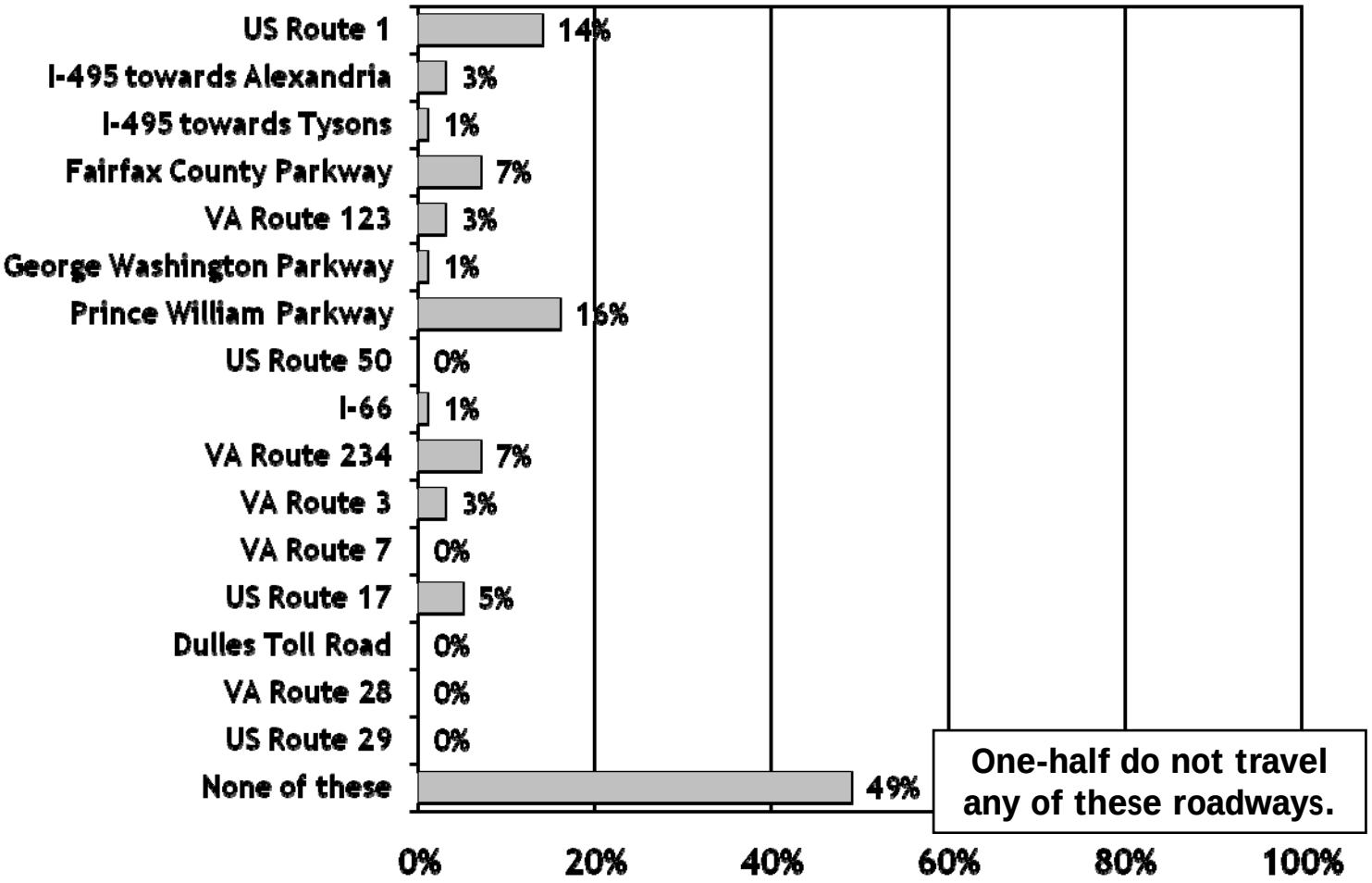

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# In Addition to I-95/I-395, Sluggers Are Most Likely to Travel on the Prince William Parkway and US Route 1

**Question asked of all respondents. Only sluggers reported in graph.**



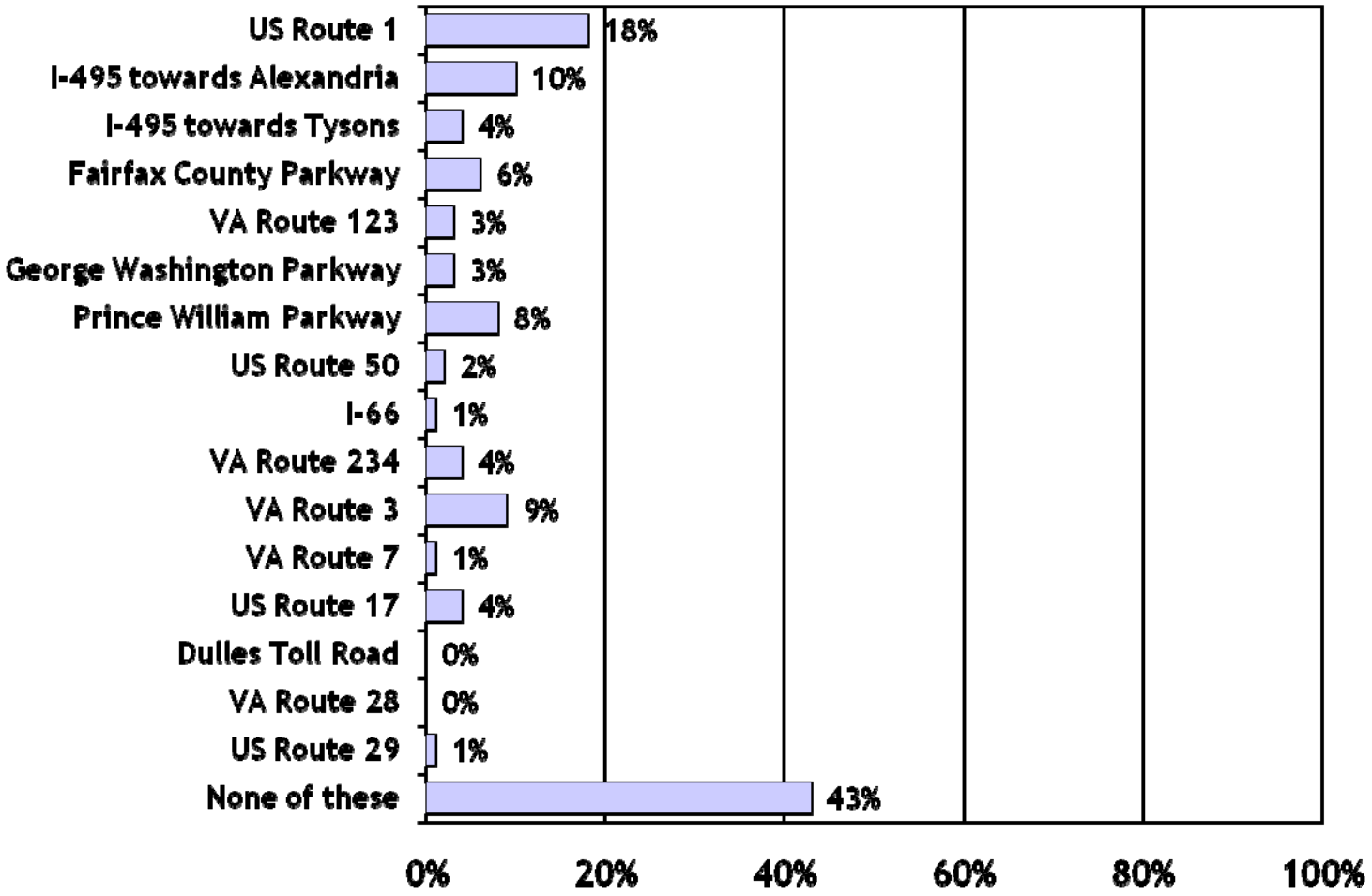

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# In Addition to I-95/I-395, Vanpoolers Most Often Travel US Route 1

**Question asked of all respondents. Only vanpoolers reported in graph.**



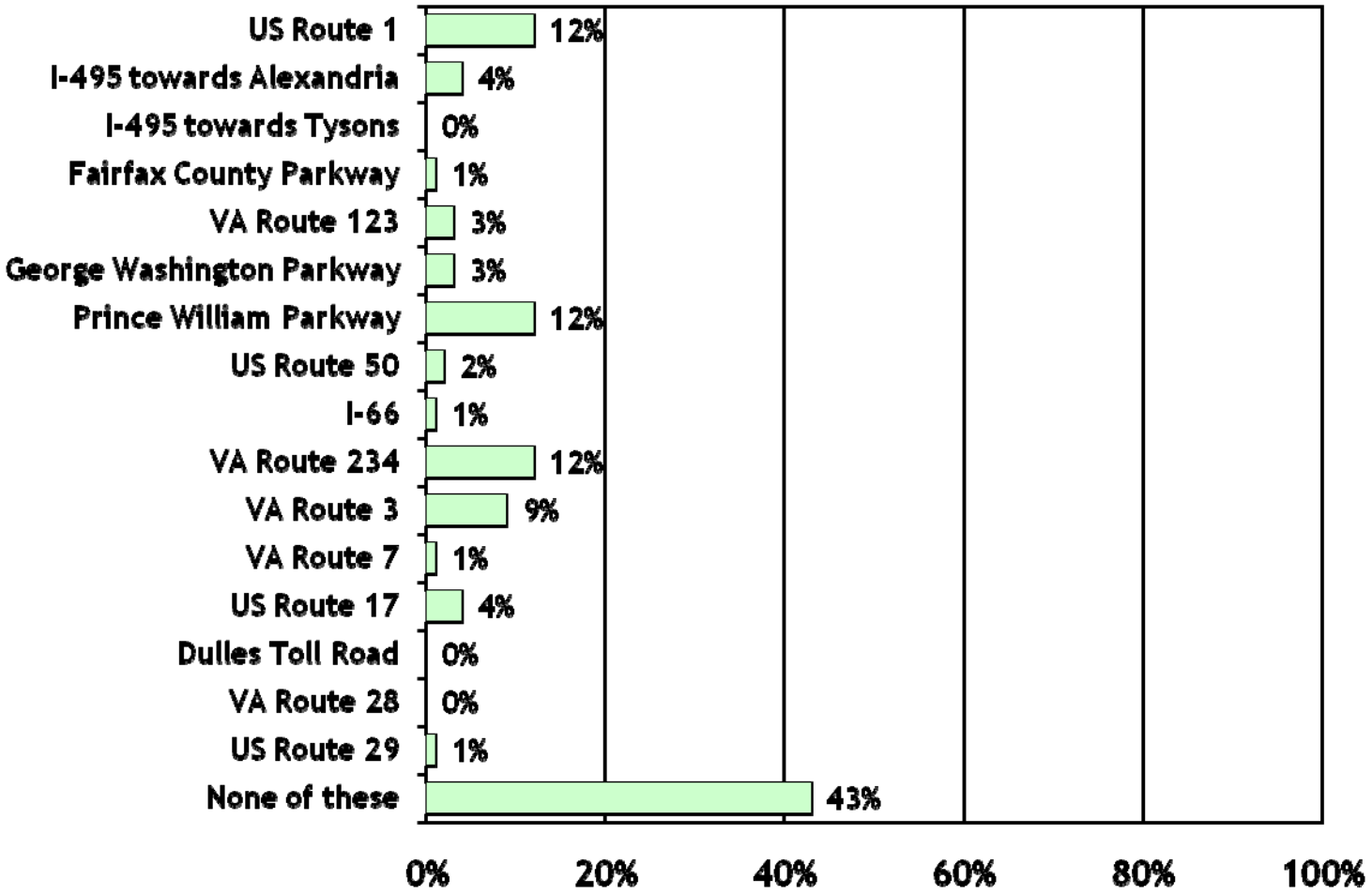

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# 12% of Bus Riders on I-95/I-395 Also Commute on US Route 1, Prince William Parkway, and VA Route 234

**Question asked of all respondents. Only bus riders reported in graph.**



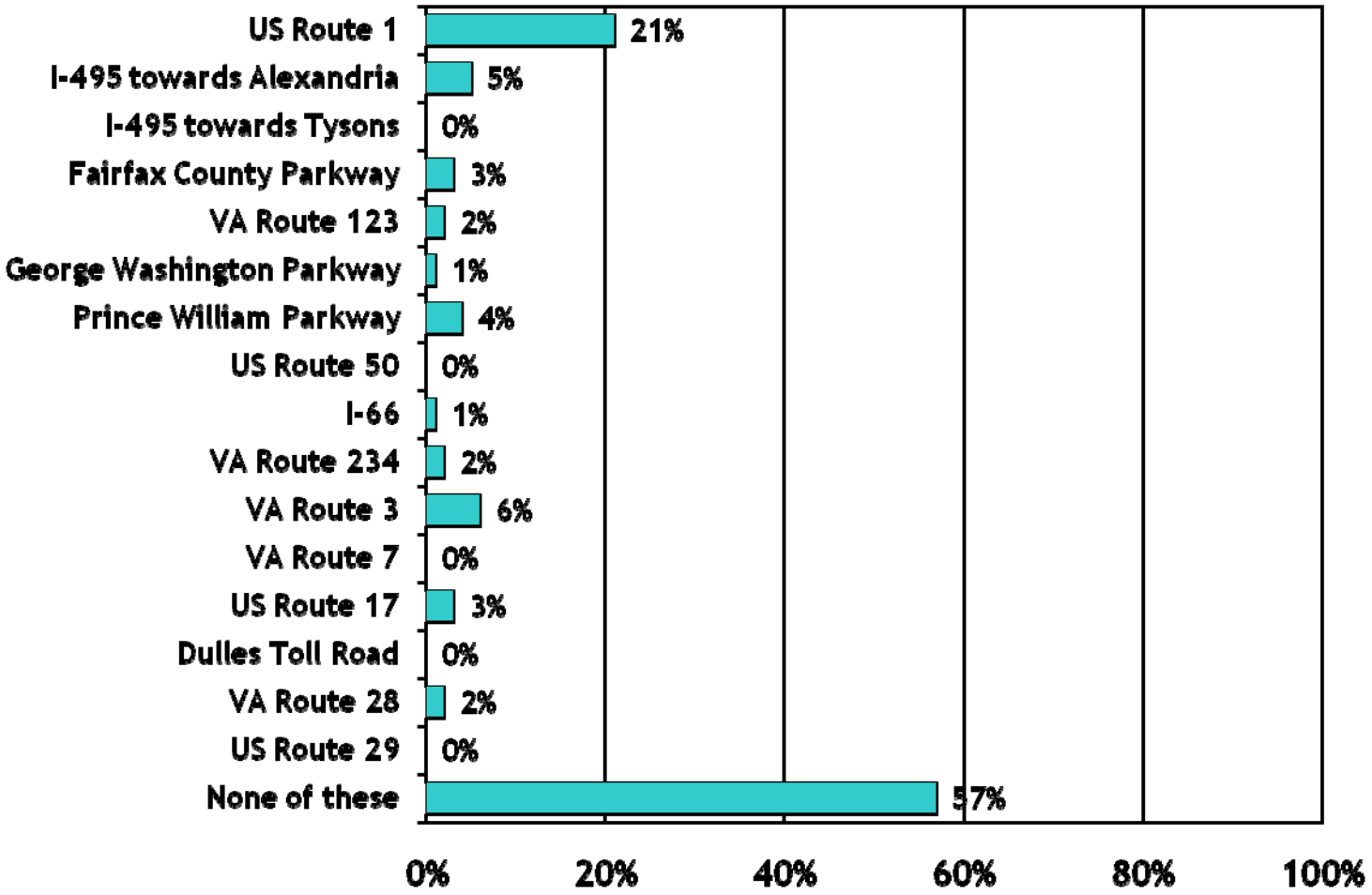

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# More than Half of VRE Riders Use None of the Other Routes Listed on Their Morning Commute

**Question asked of all respondents. Only VRE riders reported in graph.**



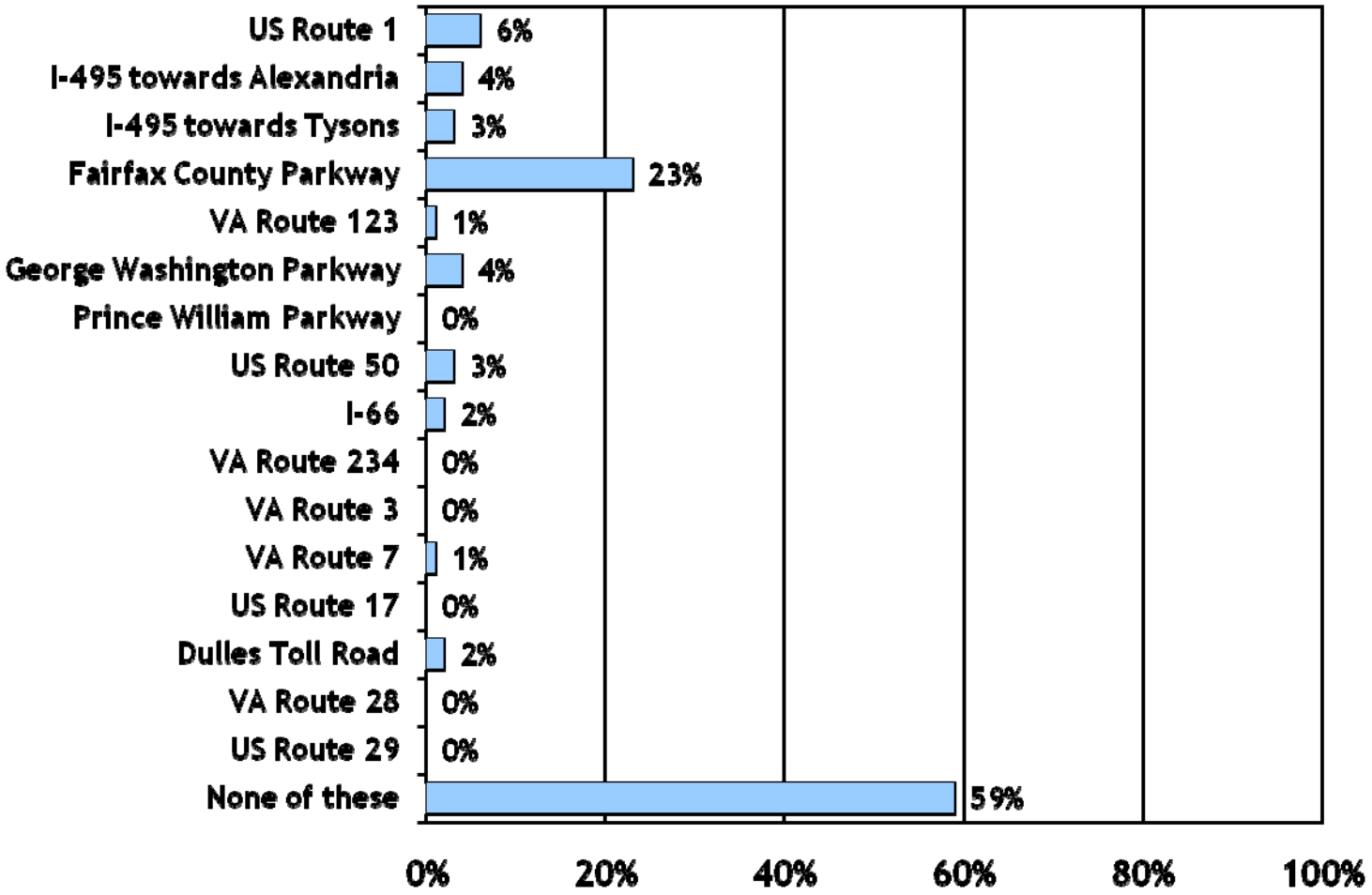

Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?



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# Nearly a Quarter of Metrorail Riders Travel on Fairfax County Parkway

**Question asked of all respondents. Only Metrorail riders reported in graph.**




Q10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?

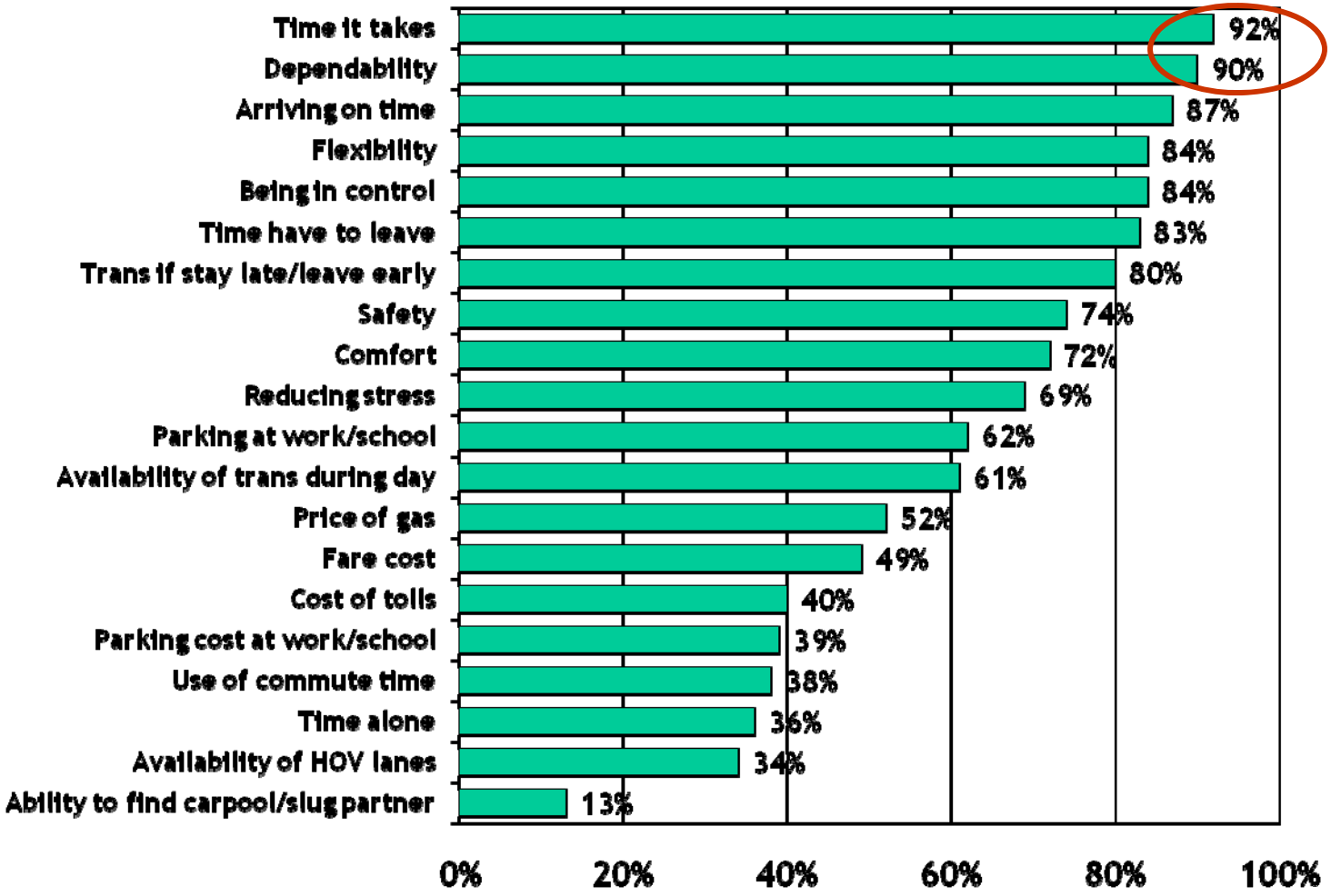


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# The Time They Have to Leave in the Morning and the Time Required for Their Commute Are Especially Important to SOVers in Deciding How to Commute

**Proportions represent SOVers. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



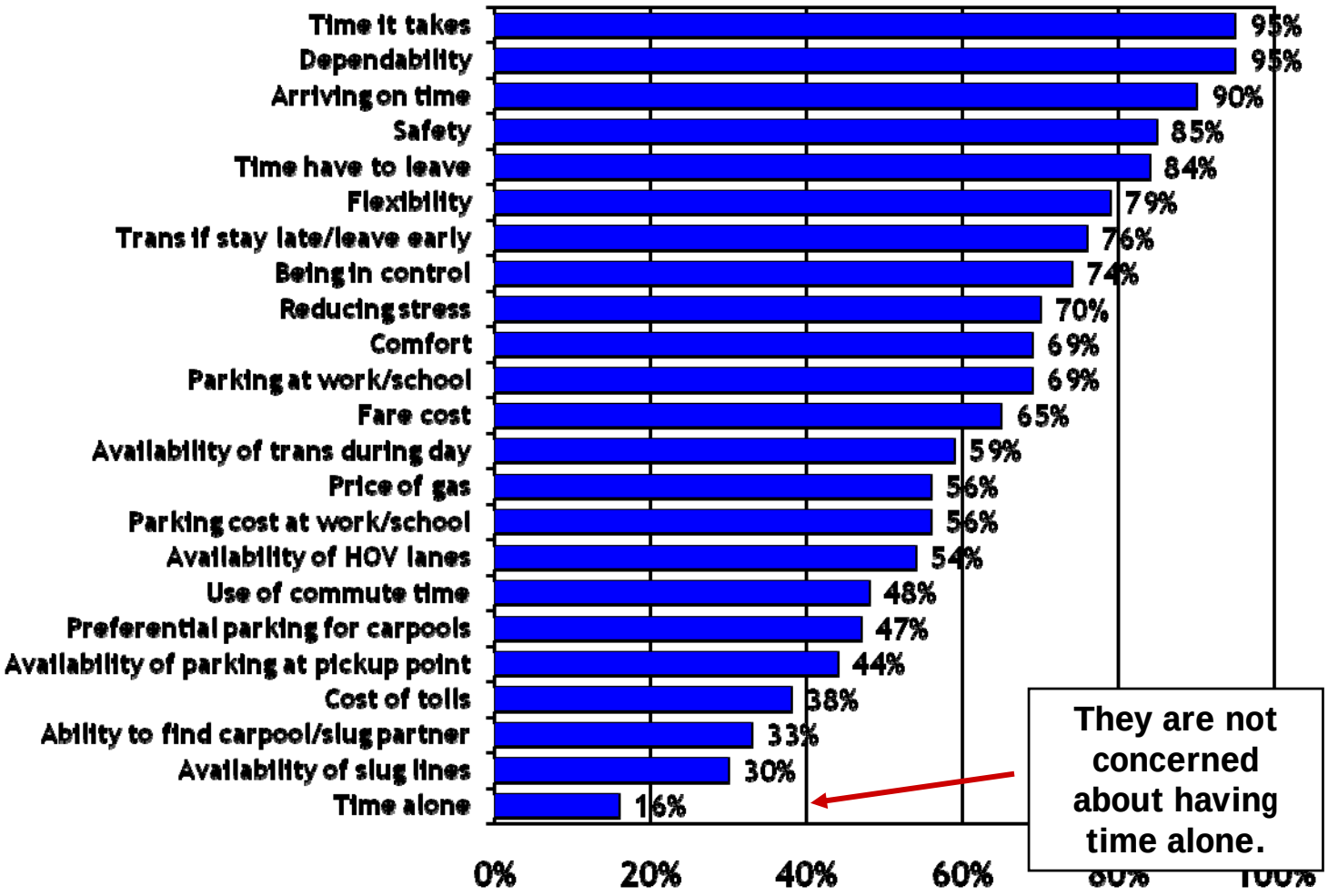



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**Proportions represent 2-person carpools. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?

# The Time It Takes to Get to Their Destination, Dependability, and Arriving on Time Are Most Important to Commuters Who Travel in a Carpool with One Other Person



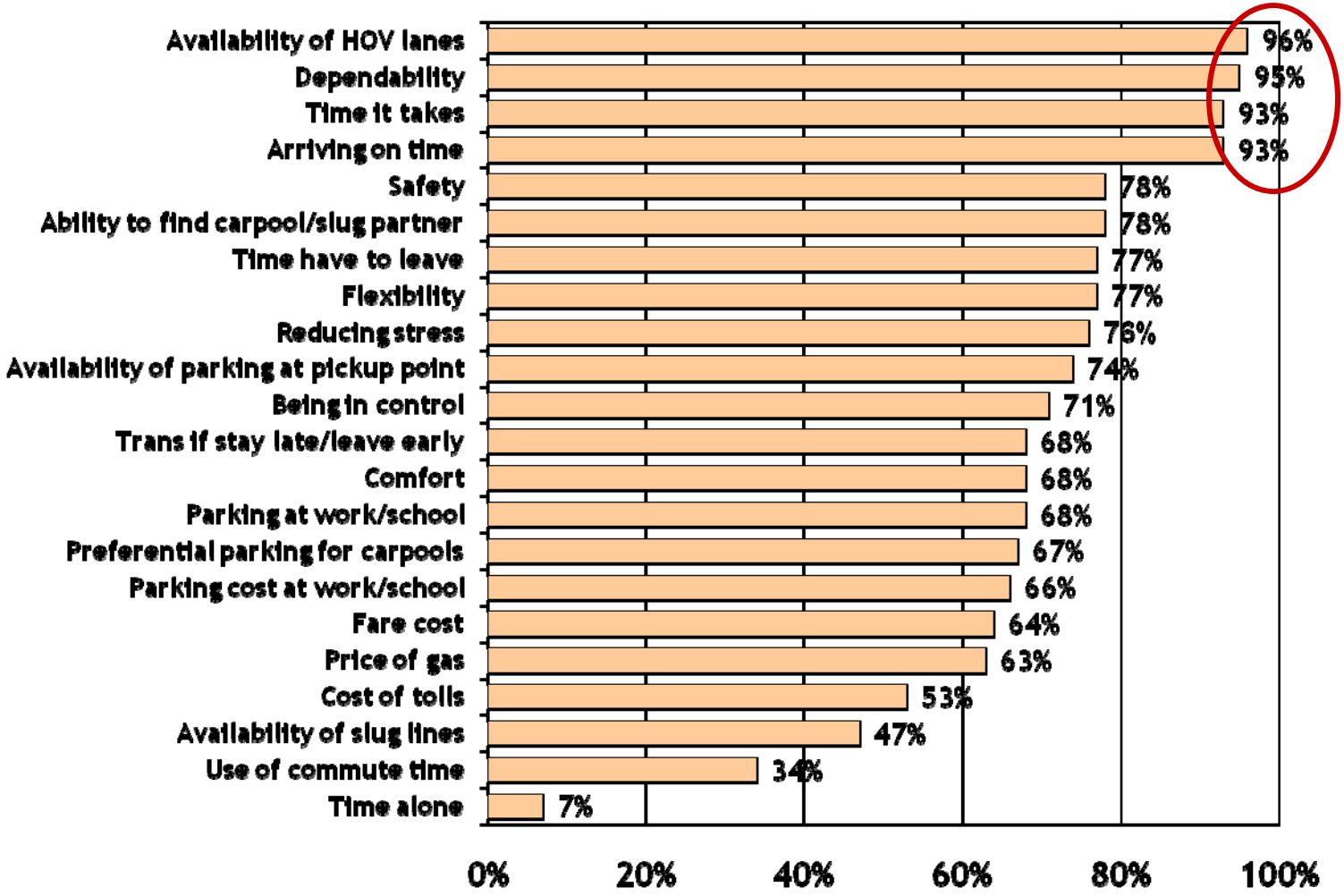



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# The HOV Lanes, Dependability, the Time It Takes, and Arriving on Time Are Most Important to Commuters in Carpools of 3 or More Persons

**Proportions represent carpools of 3 or more. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



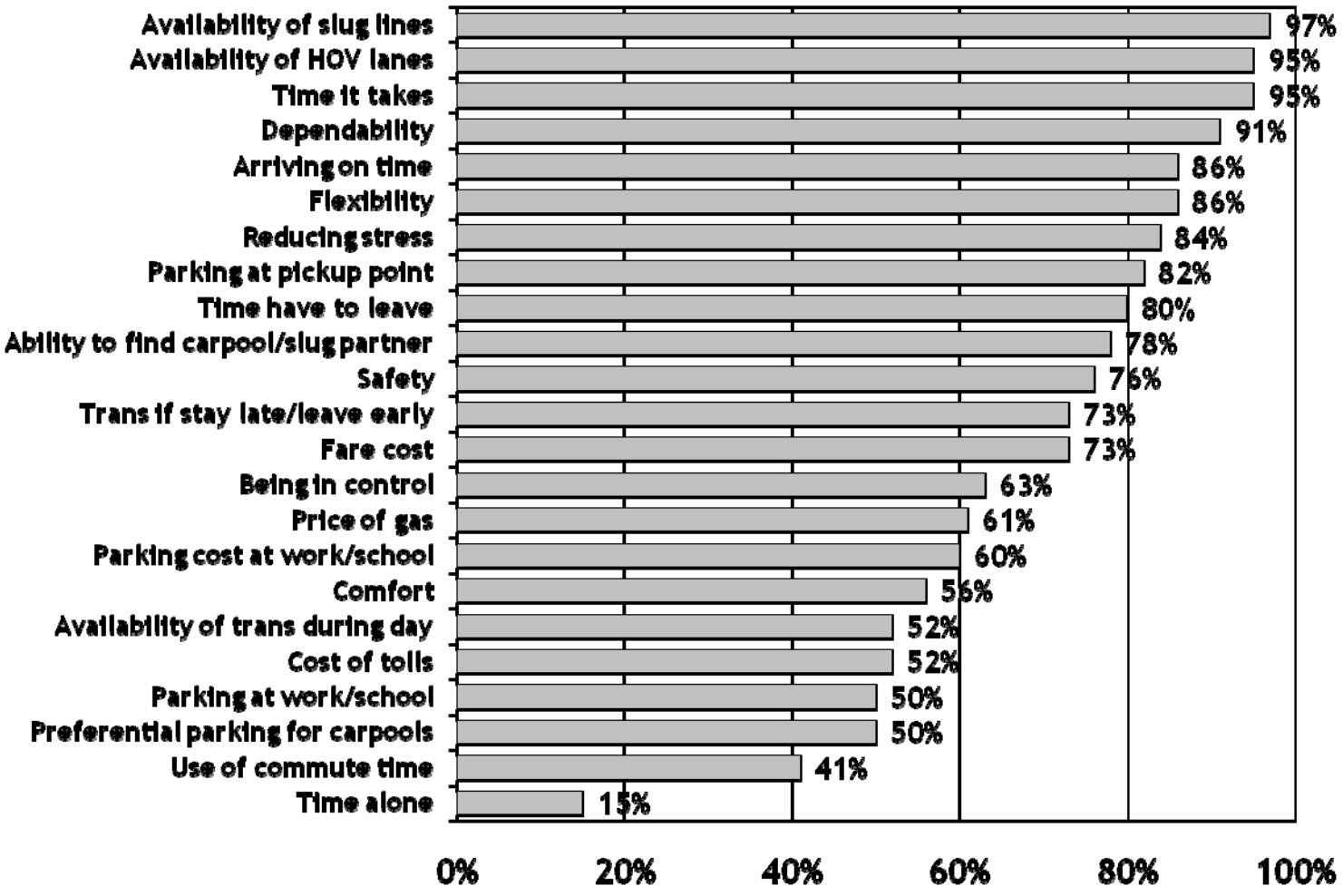



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# For Sluggers, A Slugging Support System Is Important: Availability of Slug Lines and HOV Lanes; They Also Consider the Time Required for Their Commute and Dependability

**Proportions represent sluggers. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



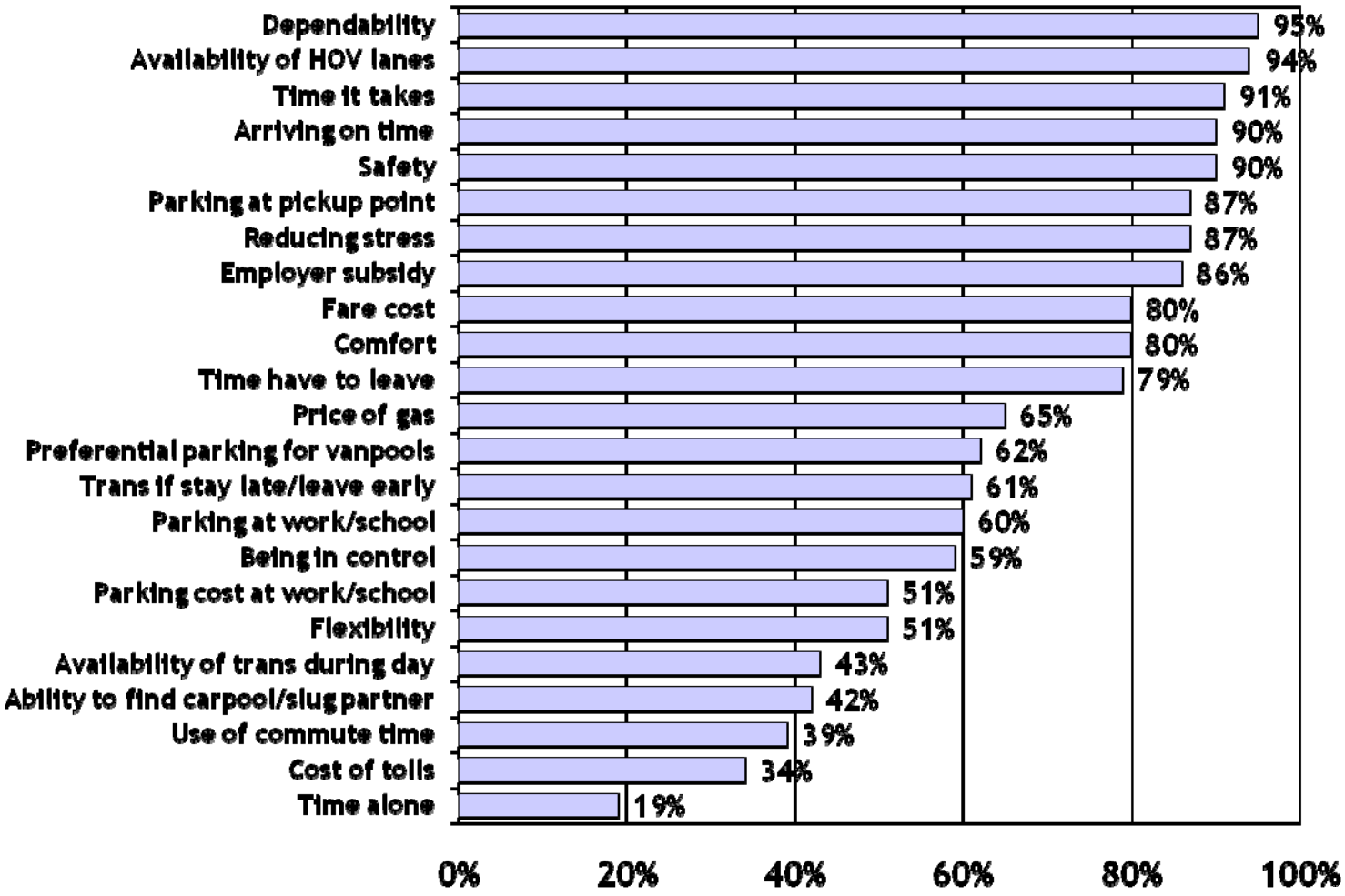



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# Dependability and the HOV Lanes Are Important to Vanpoolers – and Help them Meet Other Criteria that Are Important to Them: Time It Takes, Arriving on Time and Safety

**Proportions represent vanpoolers. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



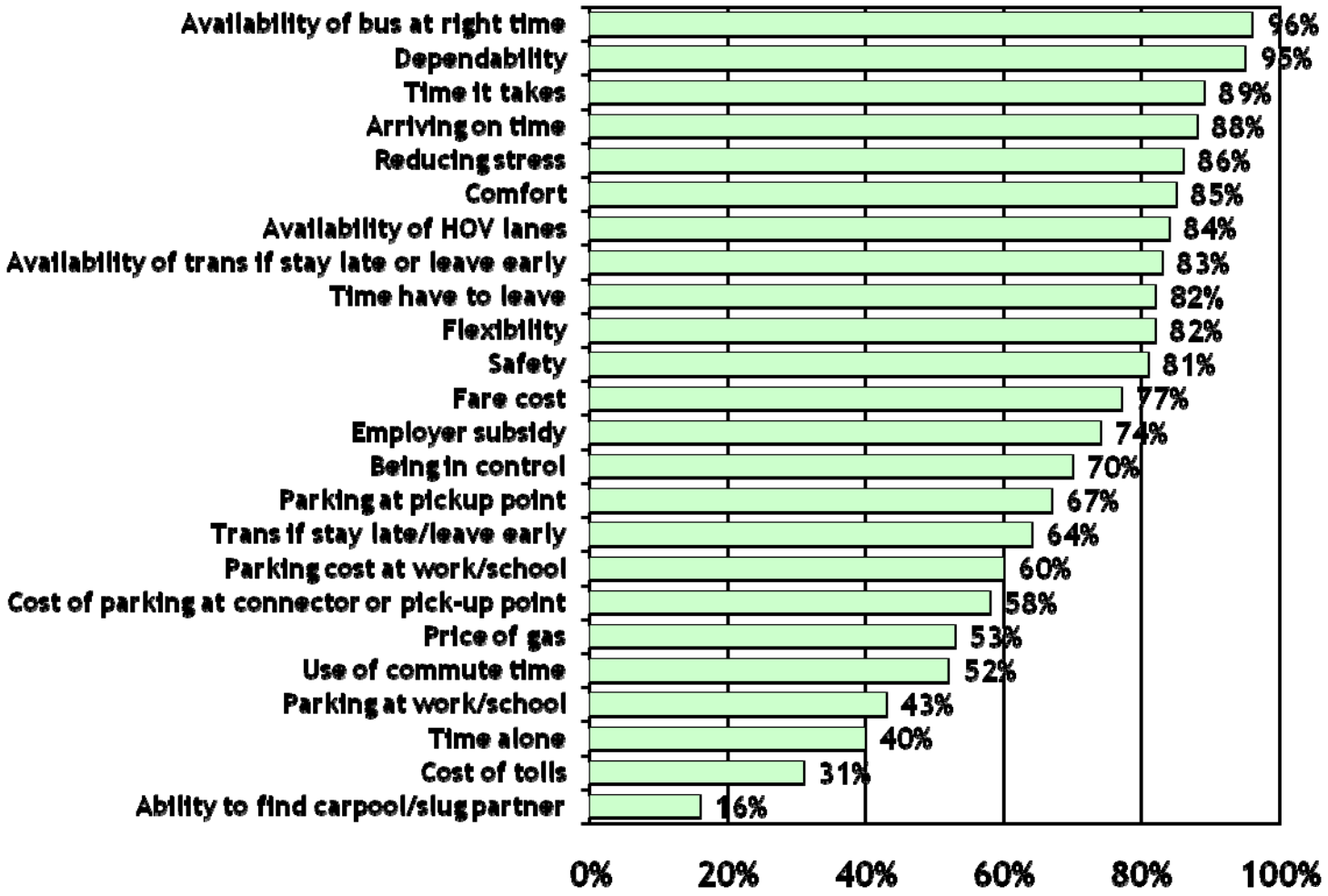



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# The Decision to Ride the Bus Revolves Around the Bus Schedule (It Comes at the "Right" Time) and Dependability

**Proportions represent bus riders. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



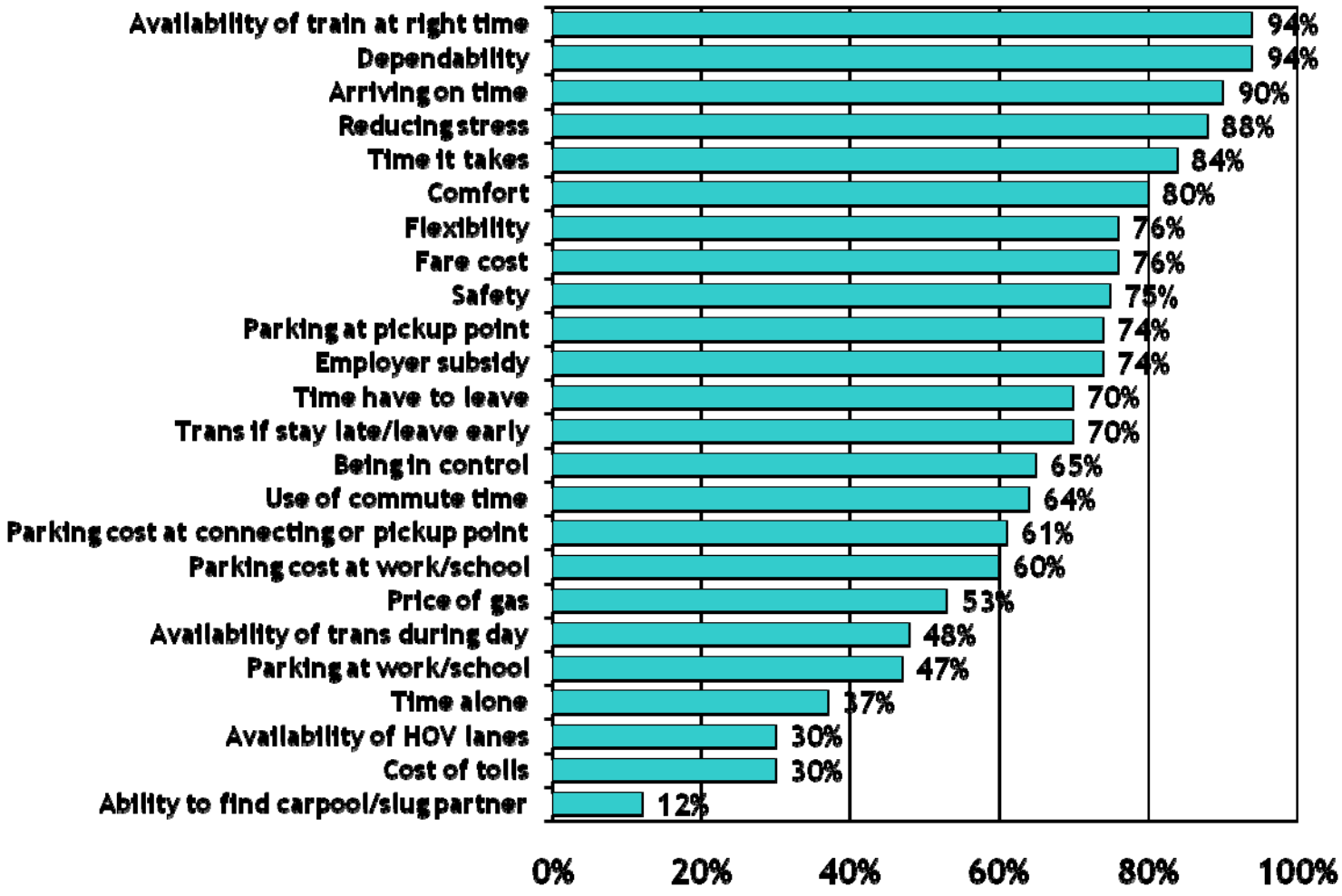



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# VRE Riders Place Most Importance on the Train Coming at the Right Time for Their Schedule and Dependability

**Proportions represent VRE riders. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?



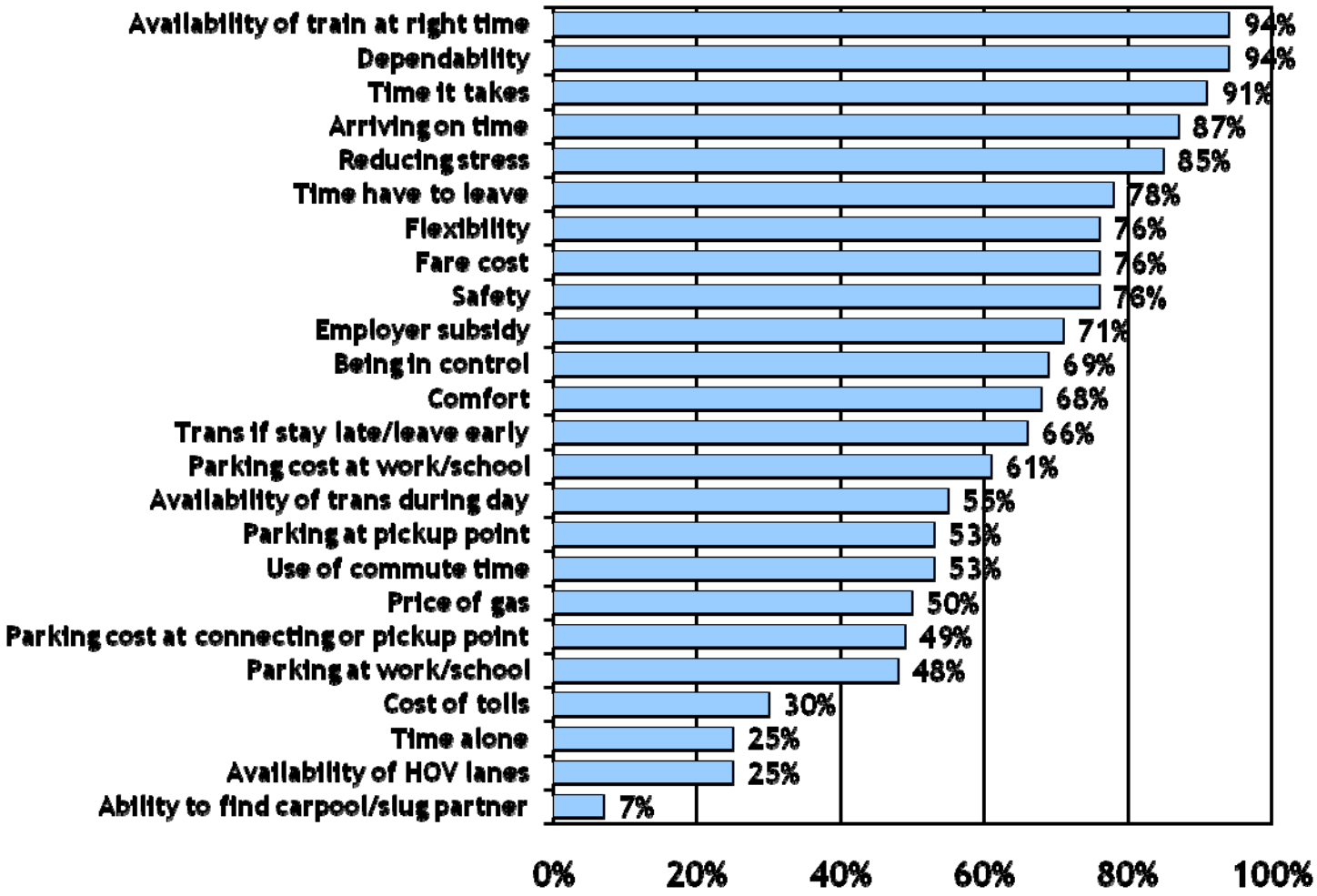



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**Proportions represent Metrorail riders. Values reported are total scores "4" and "5" where "5" means that the attribute is "very important."**

Q23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?

# Availability of the Train at the Right Time and Dependability Are Also Important to Metrorail Riders



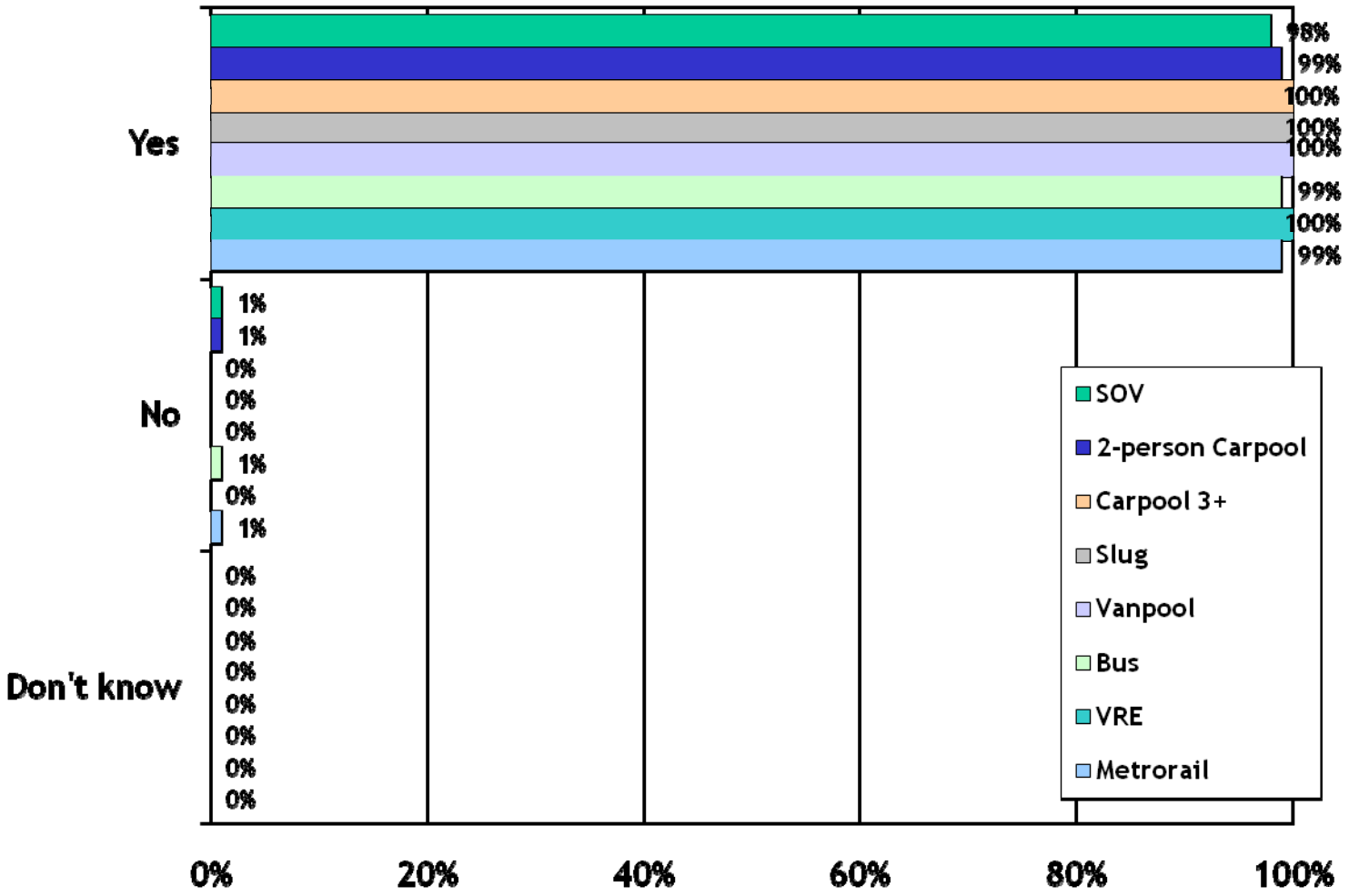



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# Awareness of the HOV Lanes on I-95/I-395 Is Universal

**Question asked of all respondents.**

Q28. Prior to this survey, were you aware of the HOV lanes?

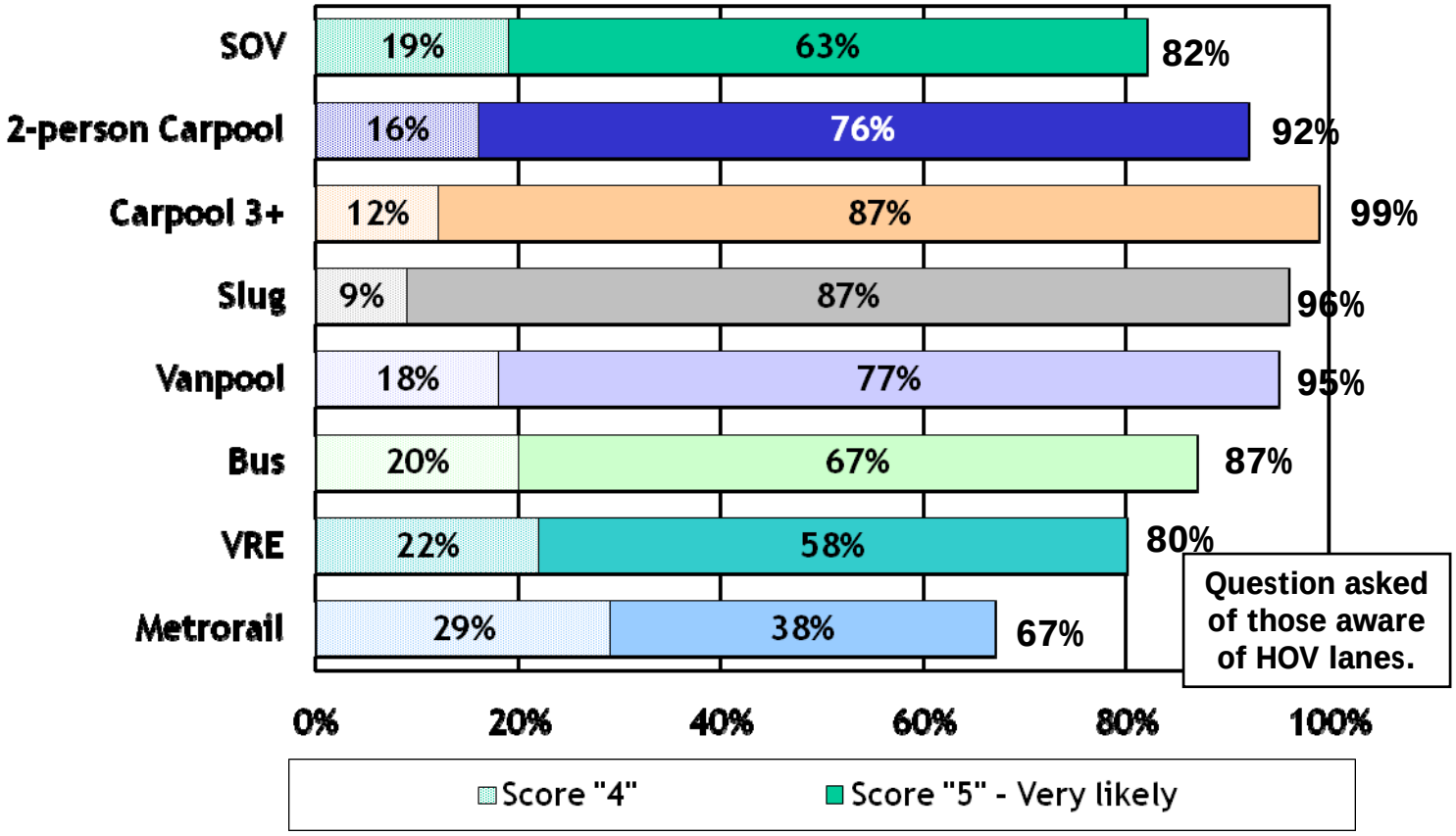





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**Note: When scores of "4" and "5" are reported on 1-5 scales, the patterned color always represents the proportion giving a score of "4", and the solid color always represents the proportion giving a score of "5".**

# Metrorail Riders Are Least Likely to Be Familiar with the HOV Lanes – Carpoolers, Sluggers and Vanpoolers Are Most Likely to Be Familiar




SOV, n=802
2-person carpool, n=125
Carpool 3+, n=230
Slug, n=605
Vanpool, n=268
Bus, n=387
VRE, n=501
Metrorail, n=183

Q29. How familiar are you with the HOV lanes on I-95/I-395? By familiar we mean, do you know where the exits and entrances for the HOV lanes are? Do you know the basic hours of operation? How familiar would you say you are with the HOV lanes?



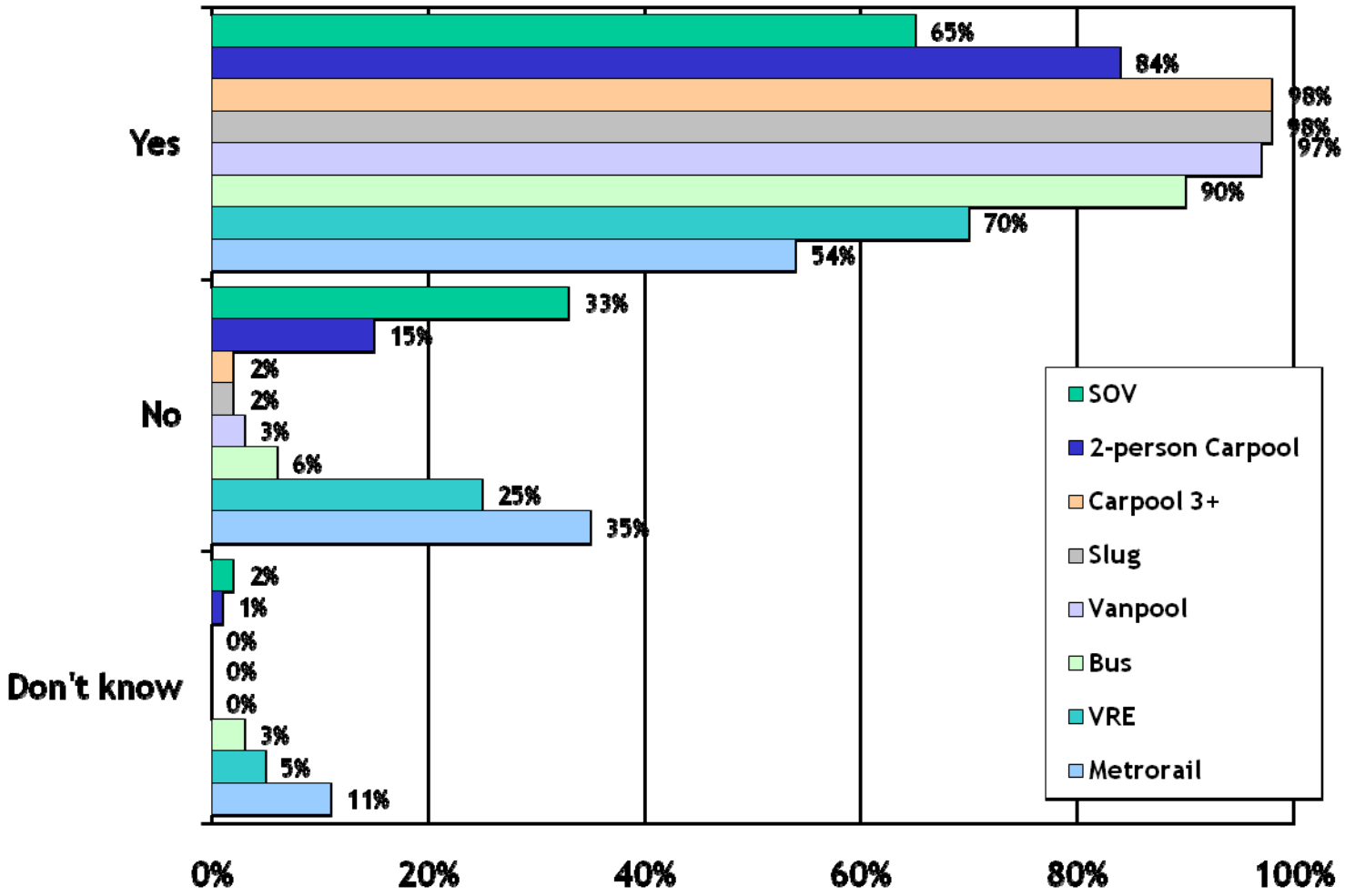
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SOV, n=802
2-person carpool, n=125
Carpool 3+, n=230
Slug, n=605
Vanpool, n=268
Bus, n=387
VRE, n=501
Metrorail, n=183

# Those in a Carpool of 3 or More, Sluggers and Vanpool Riders Are Most Likely to Have a Convenient HOV Entrance – Train Riders Are Least Likely

**Question asked of those aware of HOV lanes.**

Q30. Is there an entrance to the HOV lanes that you currently use or could use on your morning commute?



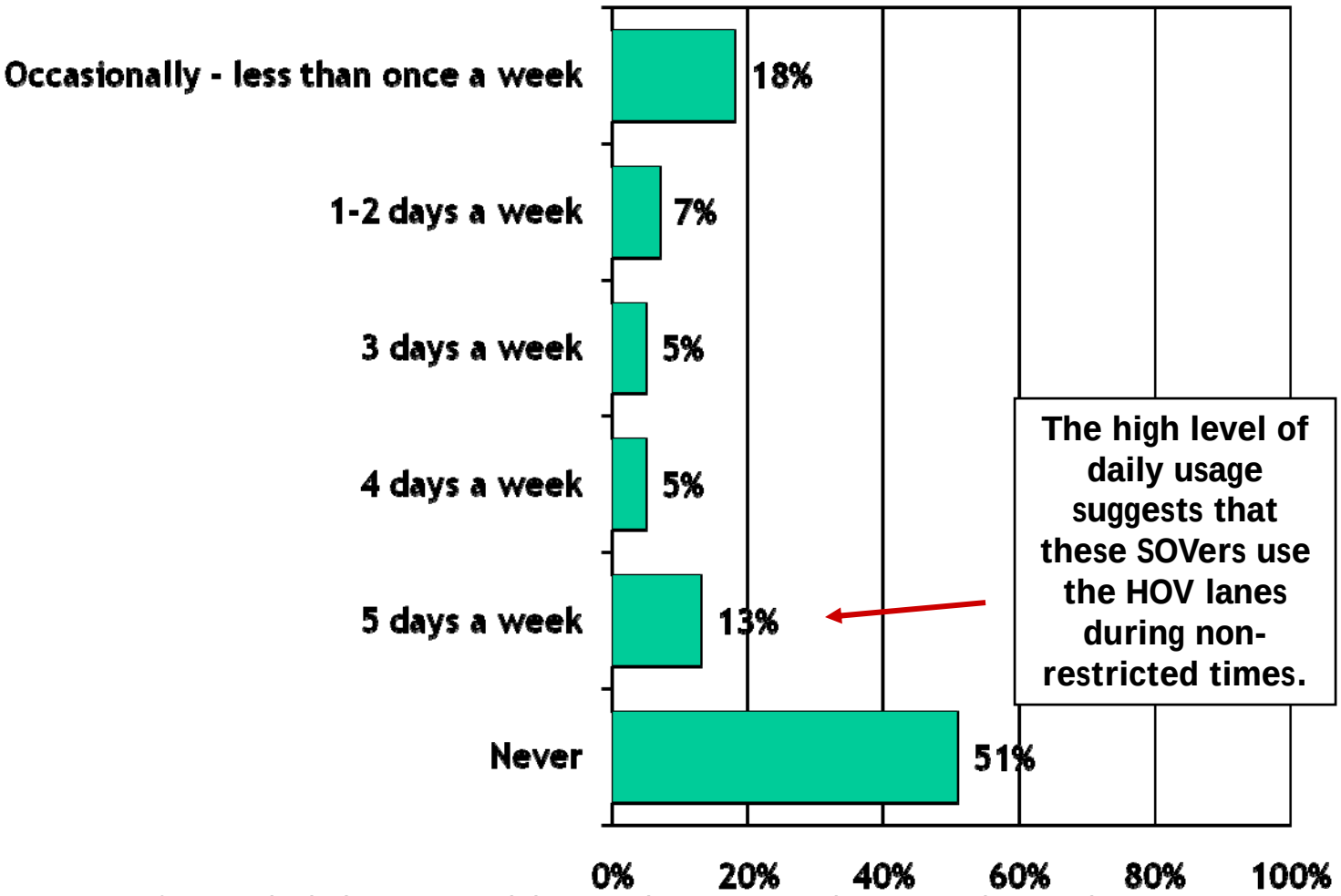



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n=520

# If SOVers Use the HOV Lanes, They Most Often Use the Lanes Occasionally or Everyday

**Proportions represent HOV usage by SOVers.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

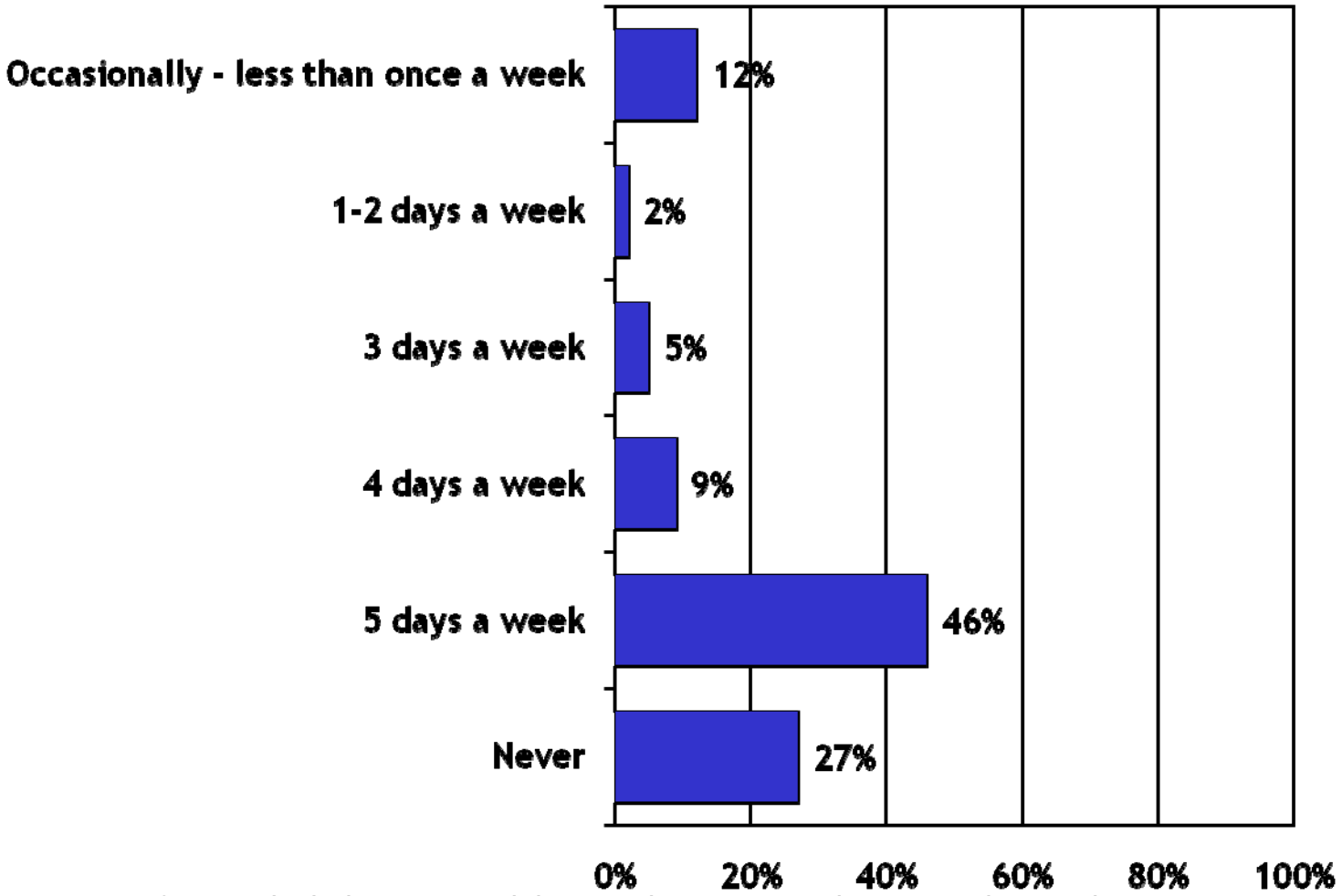


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n=105

# Nearly Half of Commuters in 2-Person Carpools Say that They Use the HOV Lanes 5 Days a Week

**Proportions represent HOV usage by commuters in 2-person carpools.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

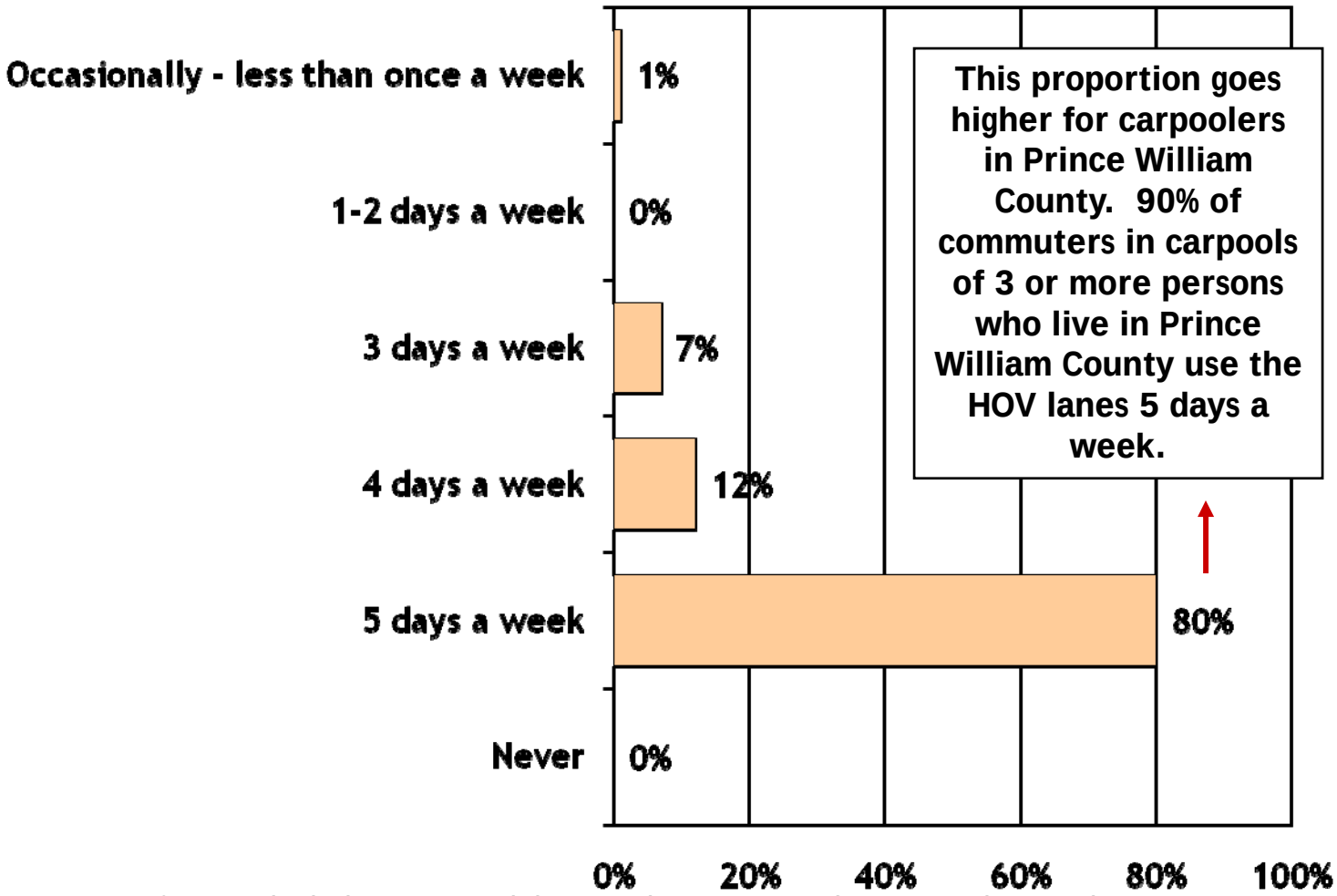


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n=225

# Most Commuters in Carpools of 3 or More Use the HOV Lanes 5 Days a Week

**Proportions represent HOV usage by commuters in carpools of 3 or more persons.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

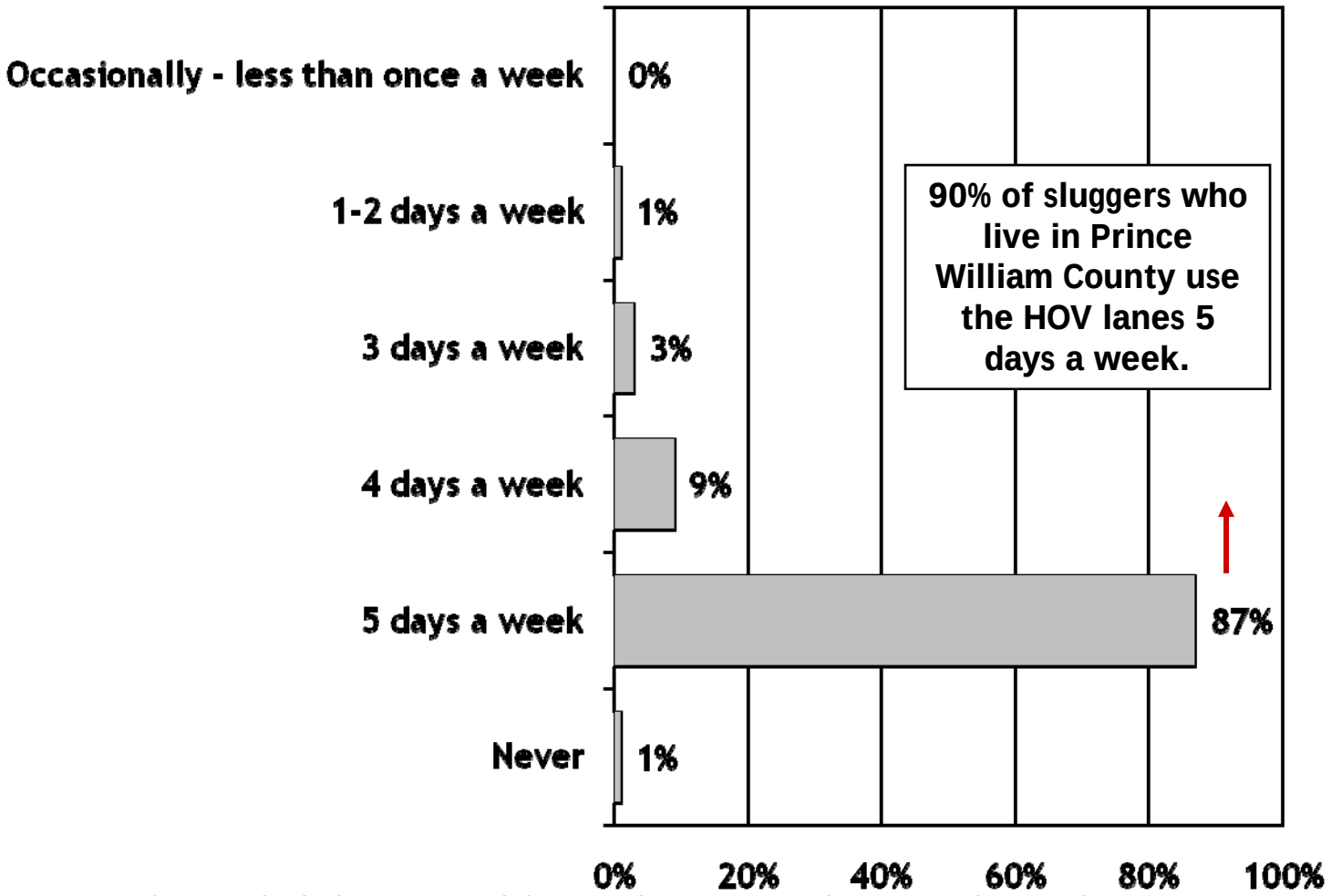


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n=591

# Nearly All Sluggers Use the HOV Lanes 5 Days a Week

**Proportions represent HOV usage by sluggers.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

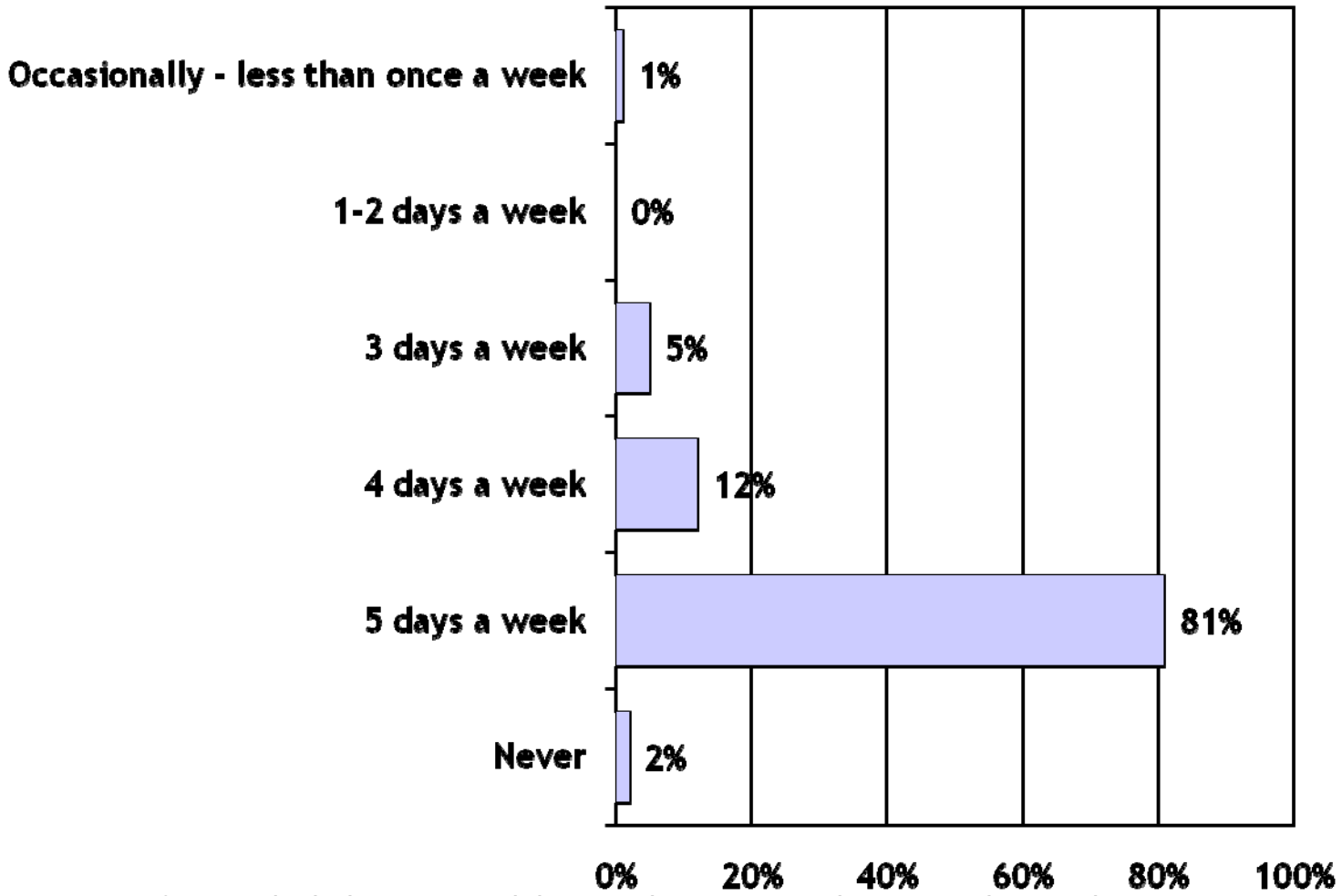


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n=259

# Eight Out of Ten Vanpoolers Use the HOV Lanes 5 Days a Week

**Proportions represent HOV usage by vanpoolers.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

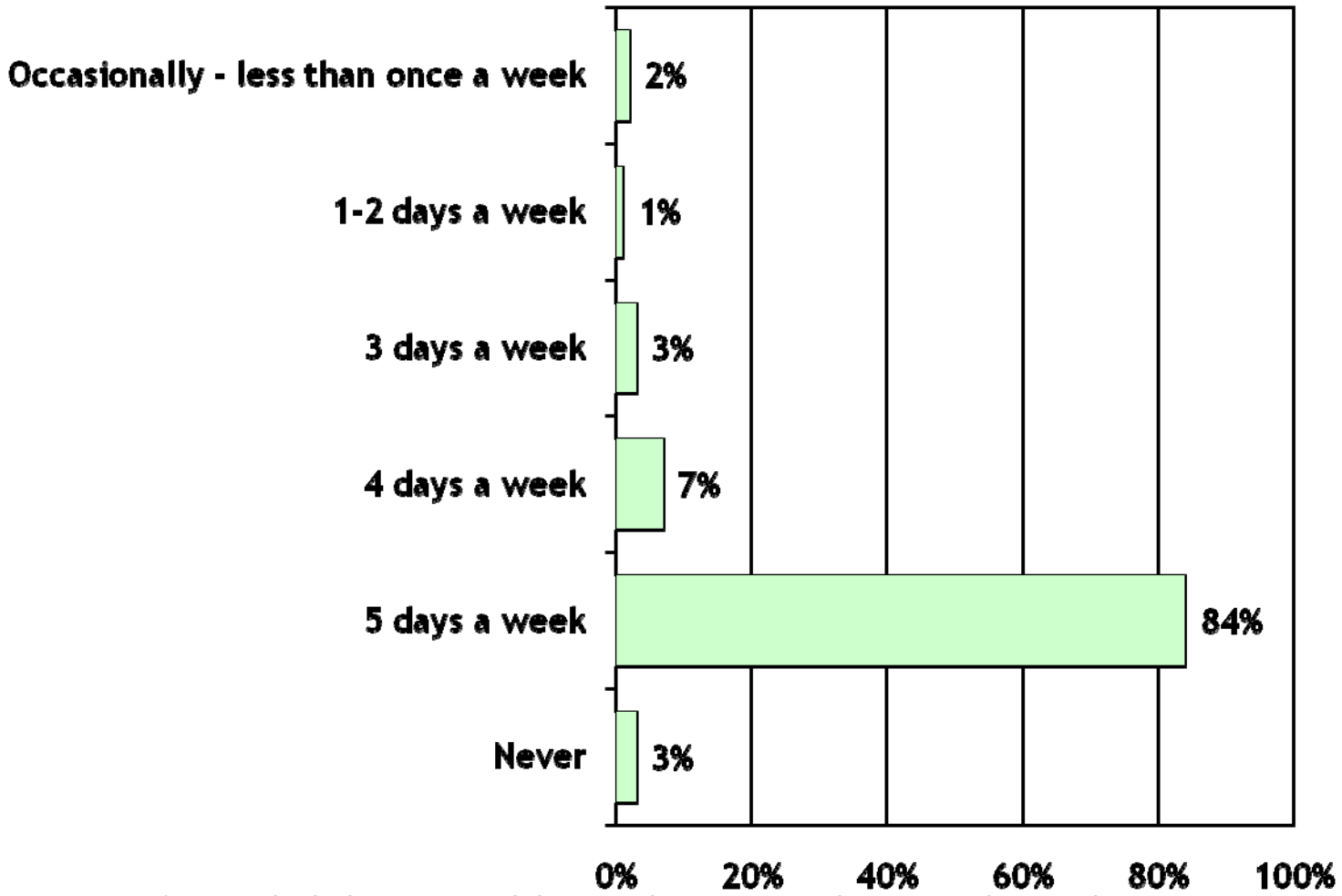


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n=350

# 84% of Bus Riders Use the HOV Lanes 5 Days a Week

**Proportions represent HOV usage by bus riders.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

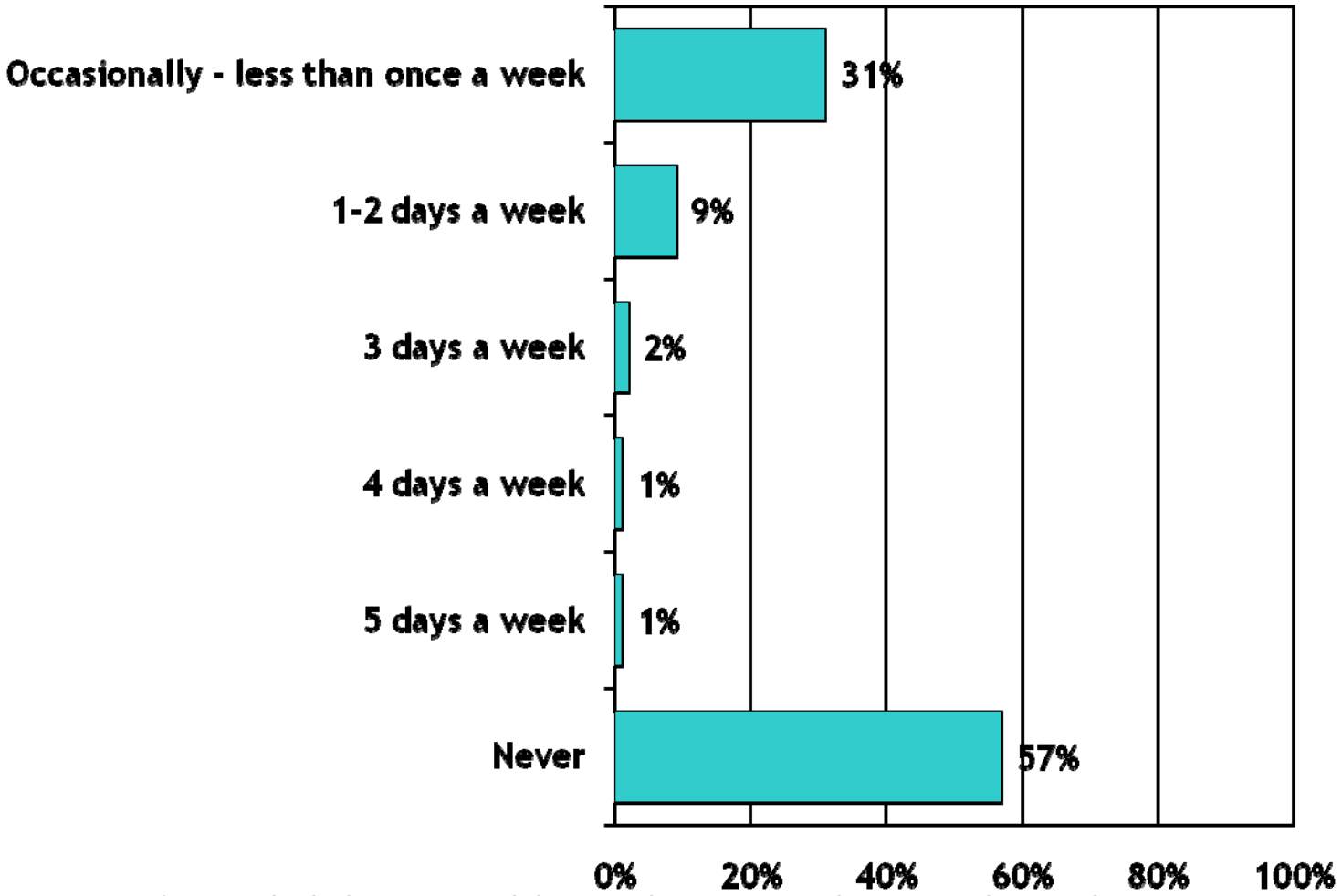


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n=351

# Slightly More than 40% of VRE Riders Use the HOV Lanes at Least Occasionally

**Proportions represent HOV usage by VRE riders.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

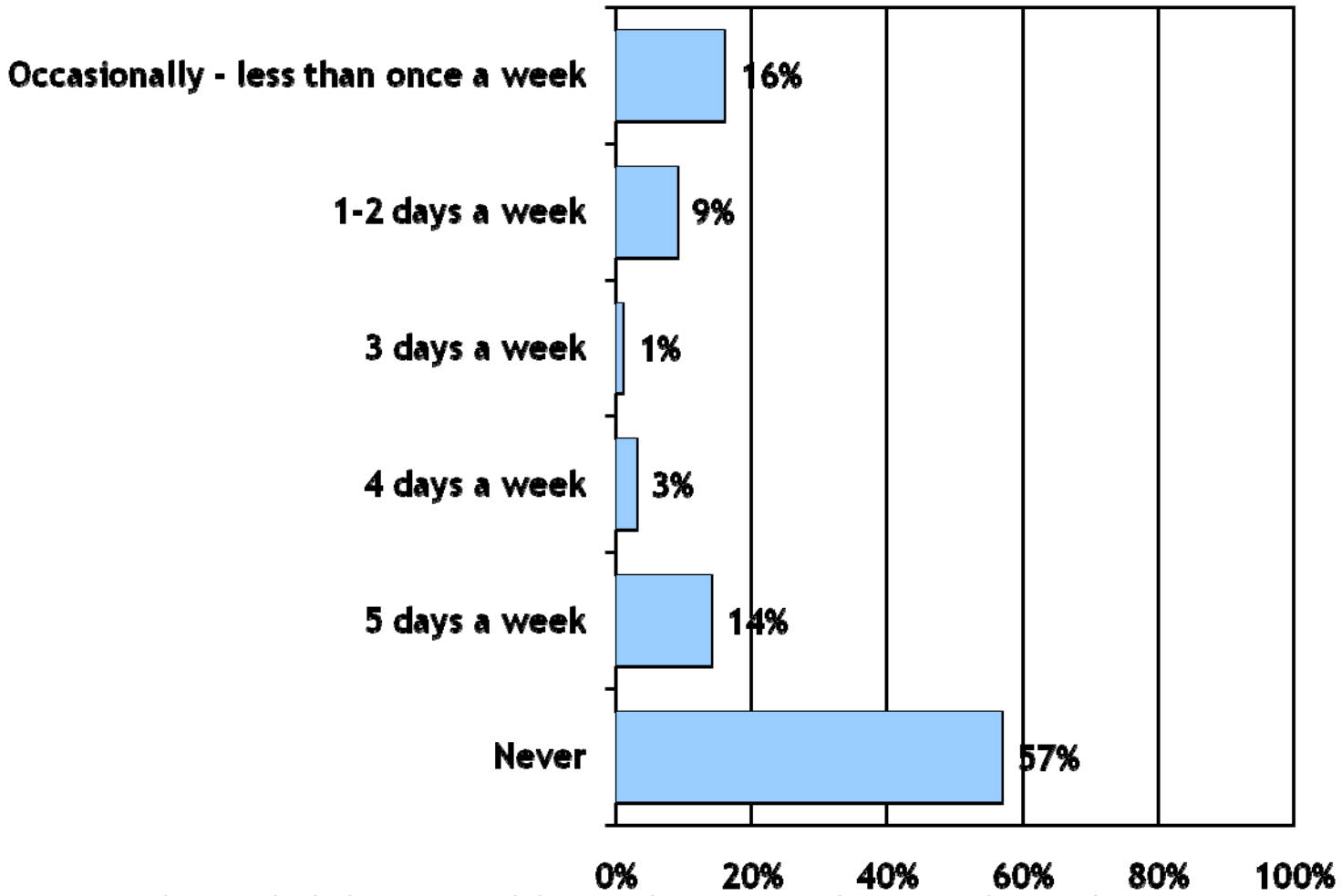


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n=99

# More than Half of Metrorail Riders Never Use the HOV Lanes

**Proportions represent HOV usage by Metrorail riders.**




Q31. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?



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SOV, n=641
2-person carpool, n=61
Bus, n=53
VRE, n=460
Metrorail, n=157

# Commuters Would Most often Continue to Use the Vehicle Type They Currently Use if There Were an HOV Entrance Convenient to their Commute

**Question asked of those who do not use HOV lanes.**

Q33. If there were an HOV entrance conveniently accessible on your morning commute and you were to use the HOV lanes, what form of transportation would you be most likely to use? Assume that parking would be available at your "pick-up" or "connection" location.

| | SOV | 2-person carpool | Bus | VRE | Metrorail |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Prearranged carpool with 2 or more others | 28 | 52 | 9 | 7 | 11 |
| Train (VRE, Metrorail, Amtrak) | 12 | 2 | 2 | 76 | 64 |
| Slug as driver | 10 | 2 | 2 | 4 | 3 |
| Bus | 5 | 10 | 79 | 3 | 8 |
| Telework/telecommute | 5 | 3 | 0 | 1 | 1 |
| Slug as passenger | 4 | 7 | 6 | 5 | 6 |
| Vanpool as driver or passenger | 3 | 3 | 0 | 2 | 1 |
| Ride a bike | 1 | 0 | 0 | 0 | 1 |
| Walk | 0 | 0 | 0 | 0 | 0 |
| Other | 32 | 21 | 2 | 3 | 6 |

**Note: Carpools of 3 or more, slugs, and vanpools not shown due to small base sizes.**



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# Outline of Report

*I. Profile of Commuters*

*II. HOT Lanes*

- Awareness
- Perceived benefits
- Anticipated usage

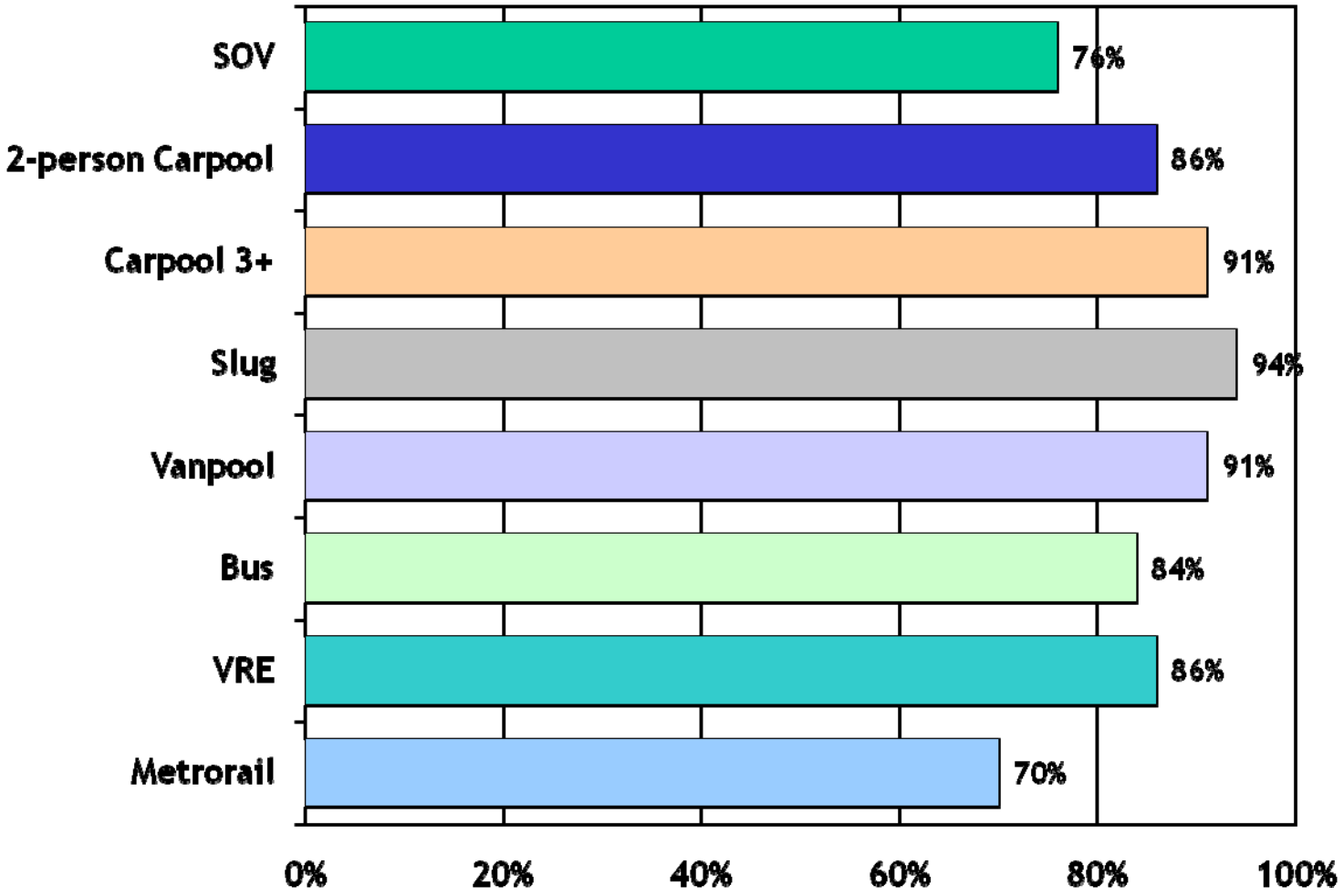
*III. Transit and TDM Improvements*



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# Awareness of the HOT Lanes Is High – Ranging from 70% among Metrorail Riders to 94% among Sluggers

**Question asked of all respondents.**




Q37. Have you ever heard or read anything about the proposed construction of the High Occupancy Toll (HOT) lanes in the I-95/I-395 corridor?



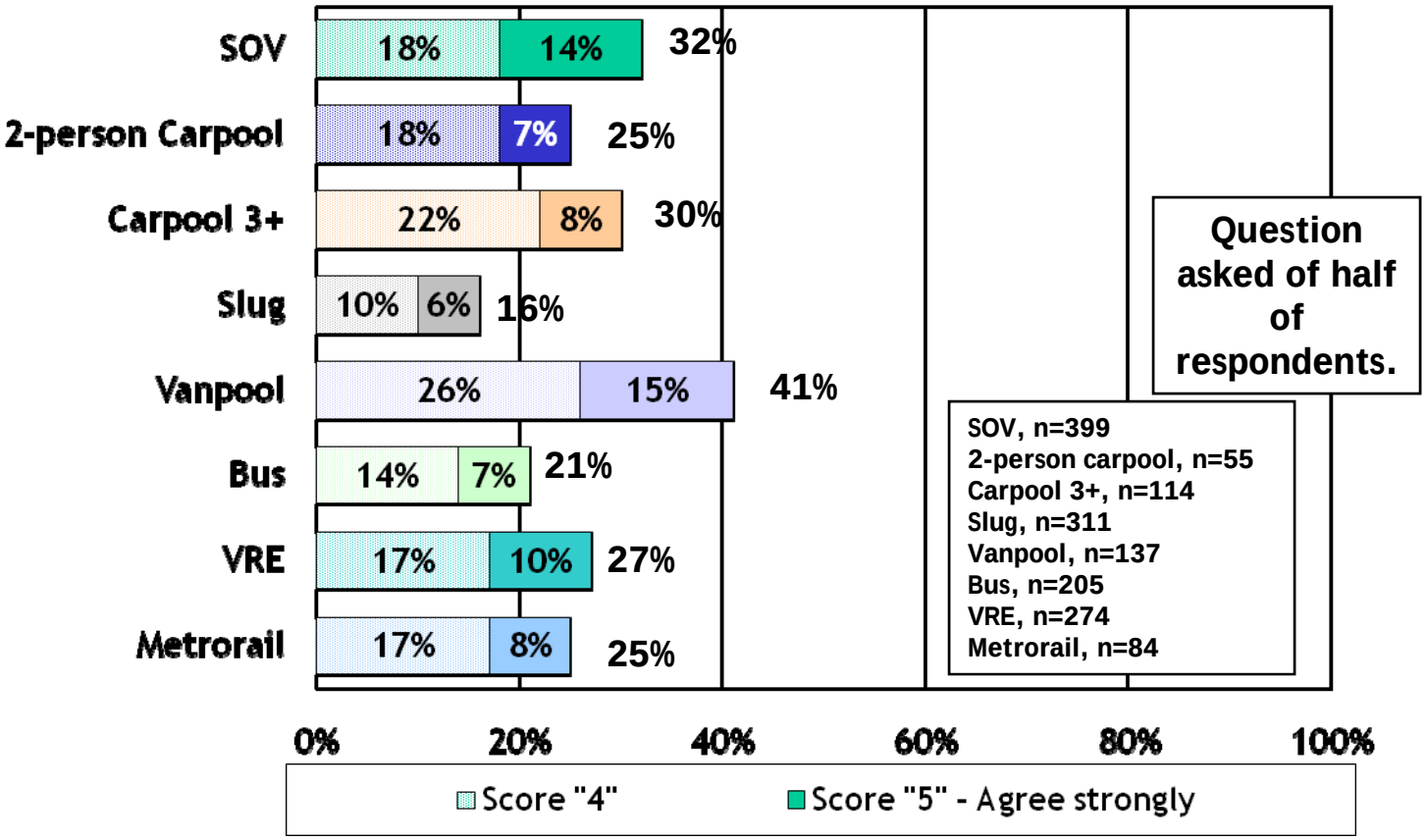
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**Note: When scores of "4" and "5" are reported on 1-5 scales, the patterned color always represents the proportion giving a score of "4", and the solid color always represents the proportion giving a score of "5".**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# Less than Half of Any Mode Agree that HOT Lanes Will Help Traffic Flow Faster in the General Purpose Lanes

*HOT lanes will help traffic to flow faster in the general purpose lanes on I-95/I-395*






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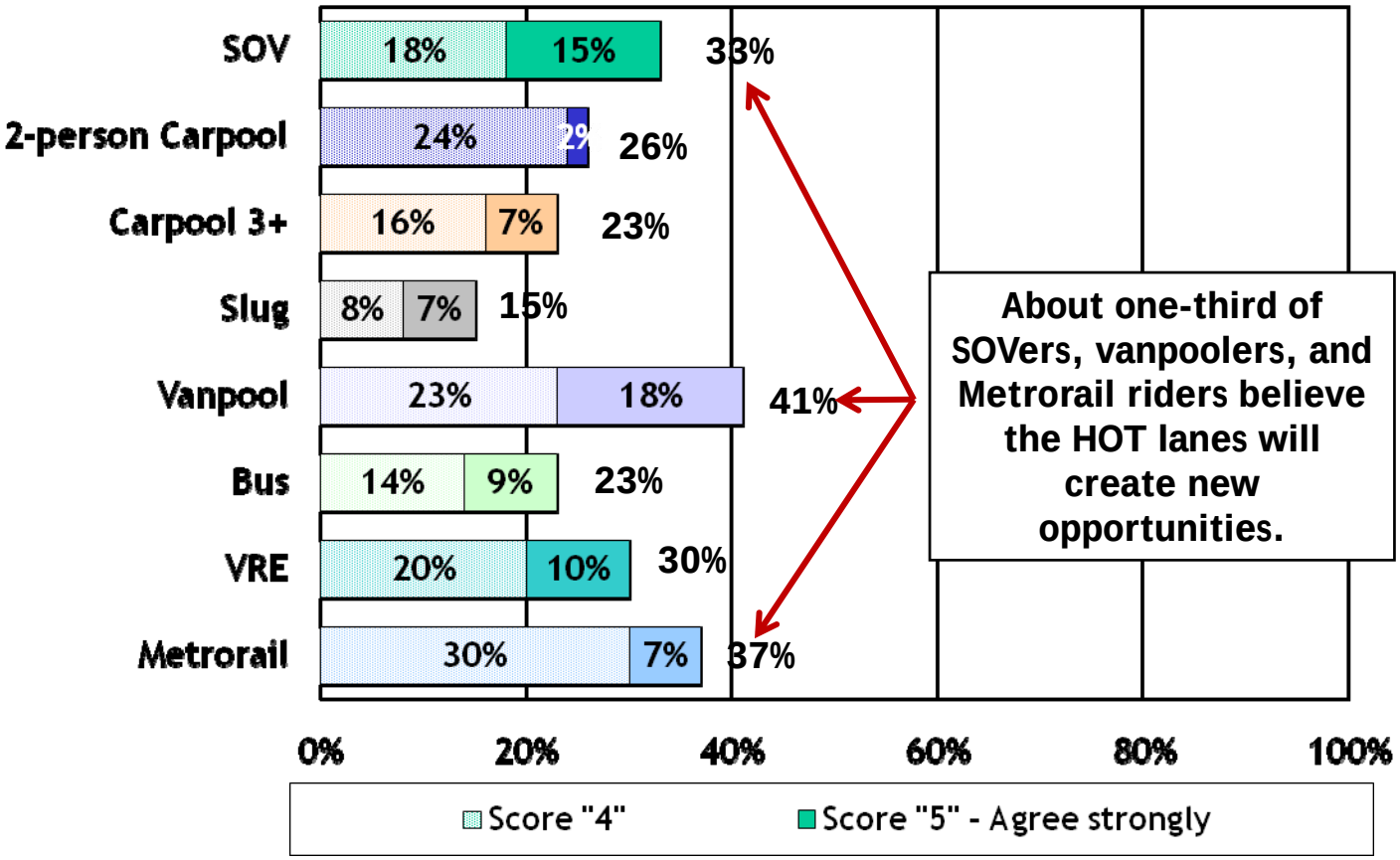
SOV, n=399
2-person carpool, n=55
Carpool 3+, n=114
Slug, n=311
Vanpool, n=137
Bus, n=205
VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# Those Who Believe the HOT Lanes Will Create New Transportation Opportunities Are in the Minority

*HOT lanes will create new transit, vanpooling, and carpooling opportunities*






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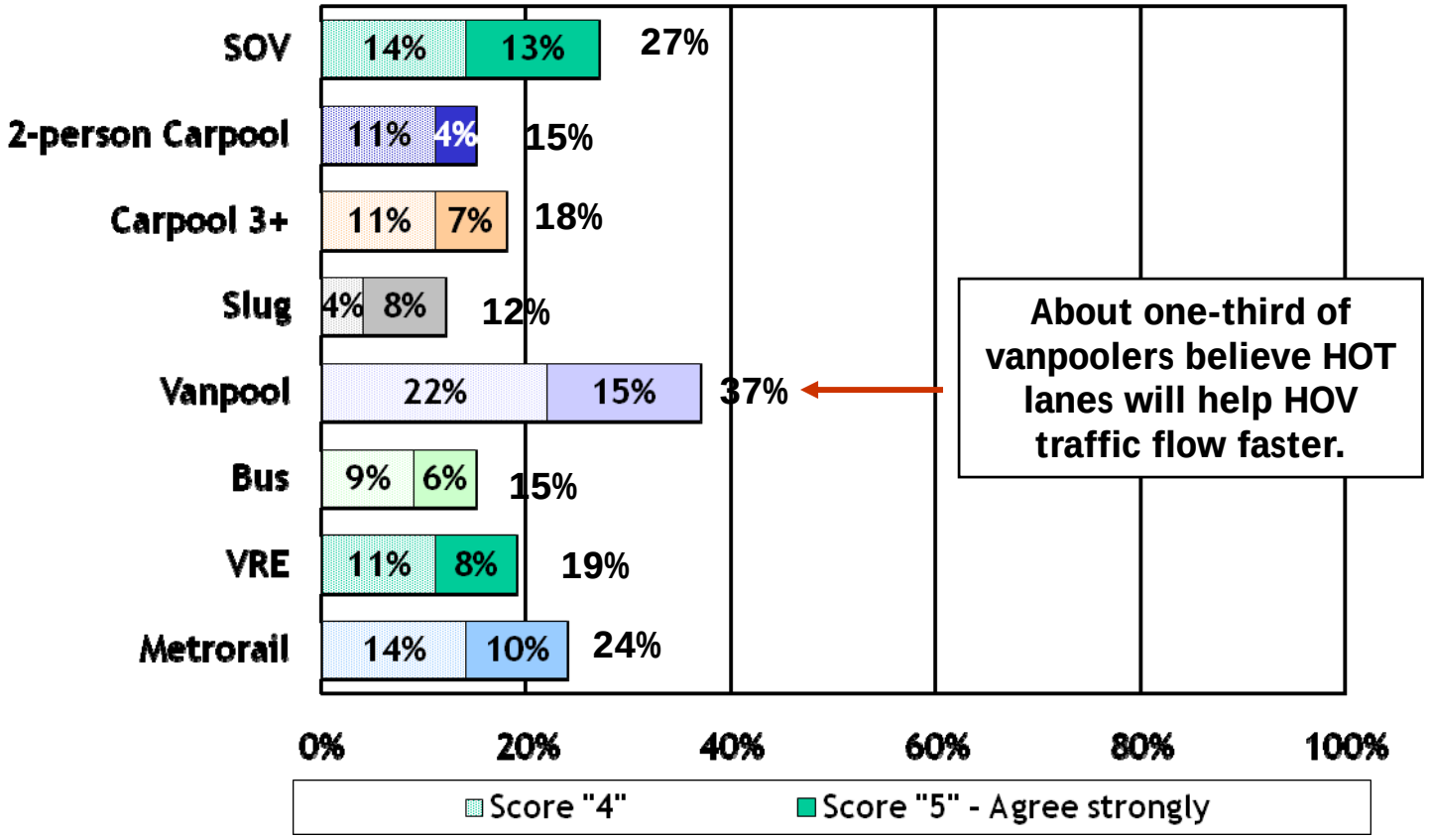
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Bus, n=205
VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# For the Most Part, Commuters Do Not Believe HOT Lanes Will Help Traffic Flow Faster in the HOV Lanes

*HOT lanes will help traffic to flow faster in the existing HOV lanes*






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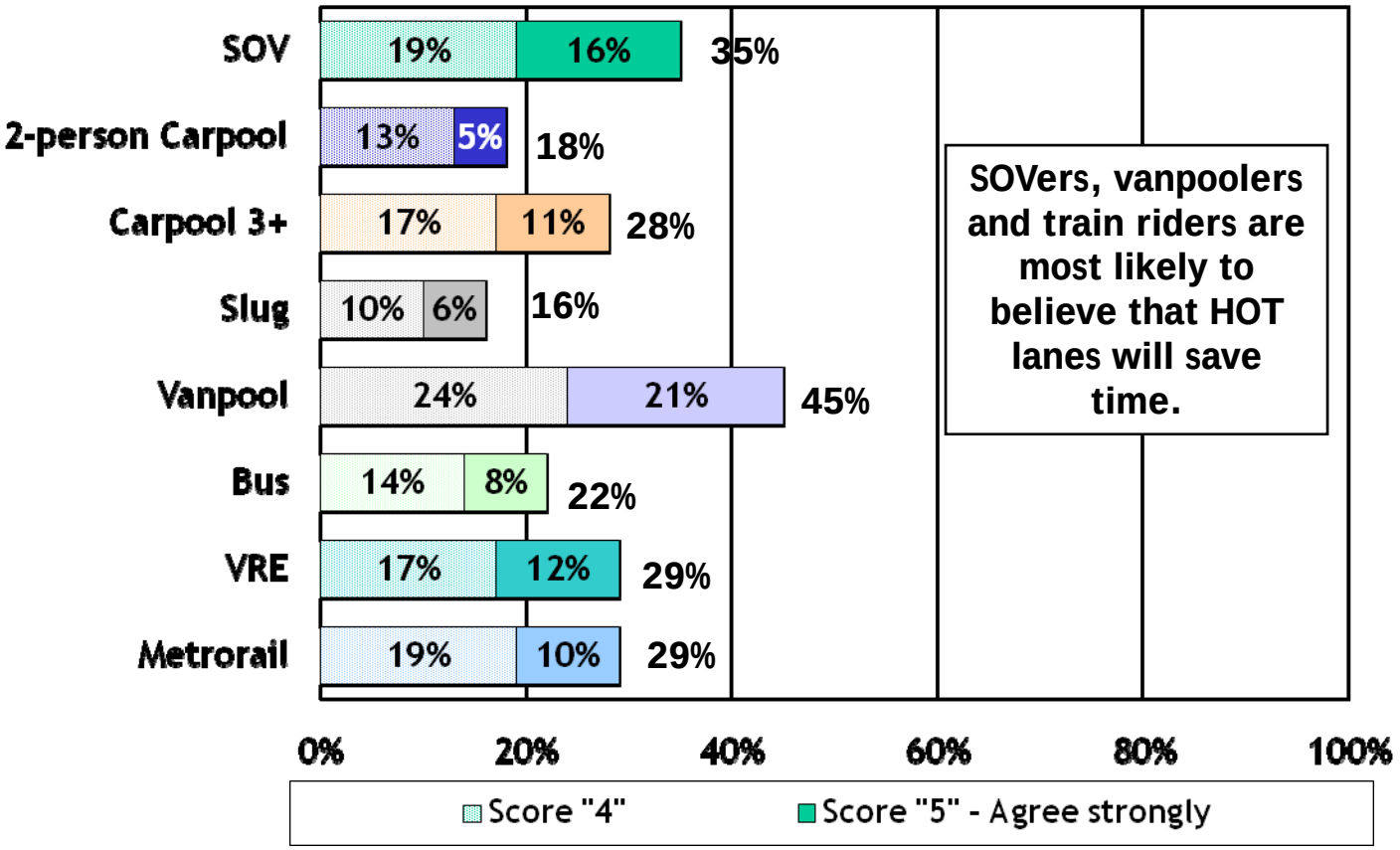
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VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# The Majority of Commuters – Across All Modes – Do Not Believe that the HOT Lanes Will Help Commuters Save Time

*HOT lanes will help commuters save time on their commutes*






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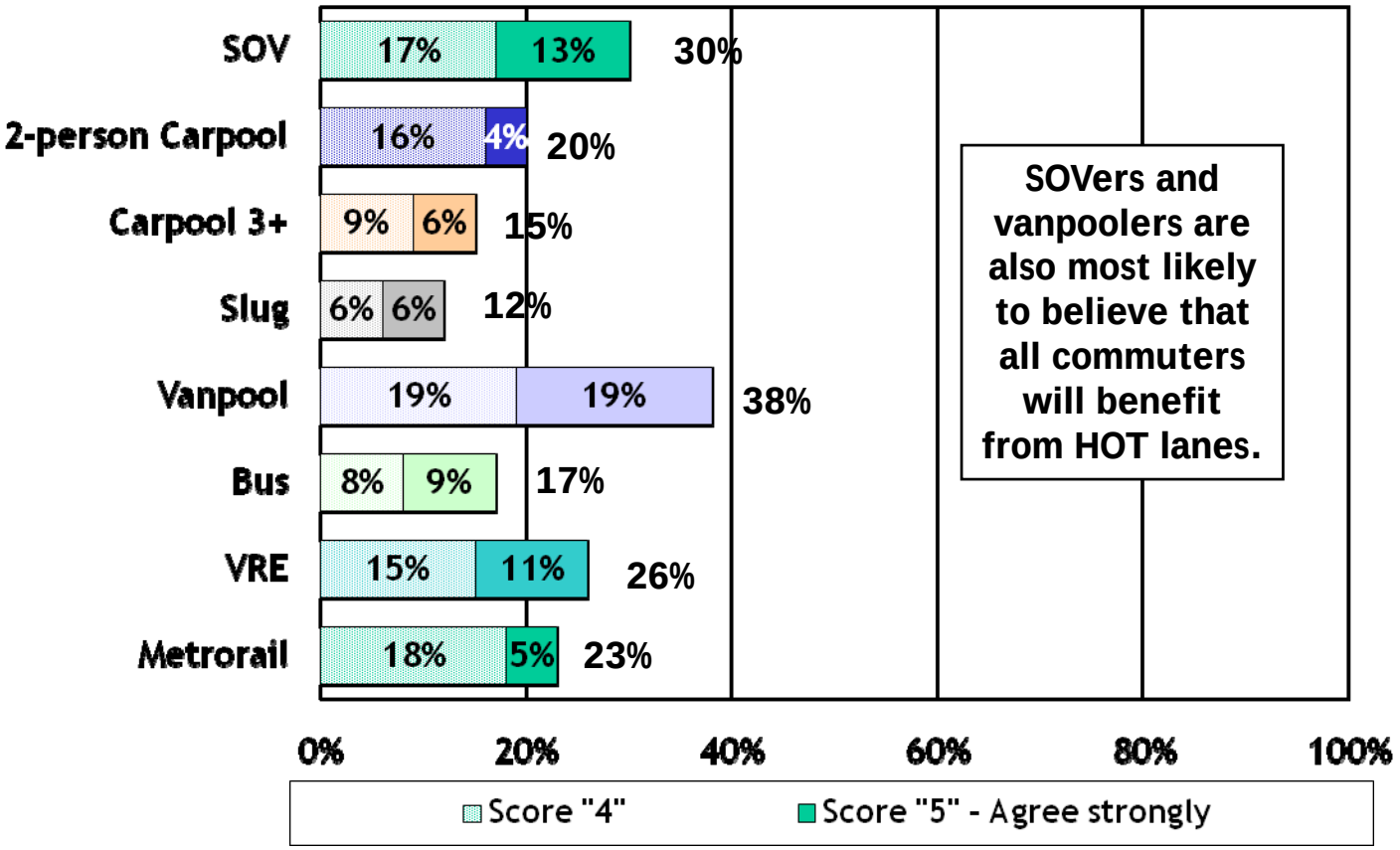
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Slug, n=311
Vanpool, n=137
Bus, n=205
VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# Commuters Don't Seem to Think that HOT Lanes Will Benefit All Commuters

*HOT lanes will benefit all commuters, even those who do not use them*






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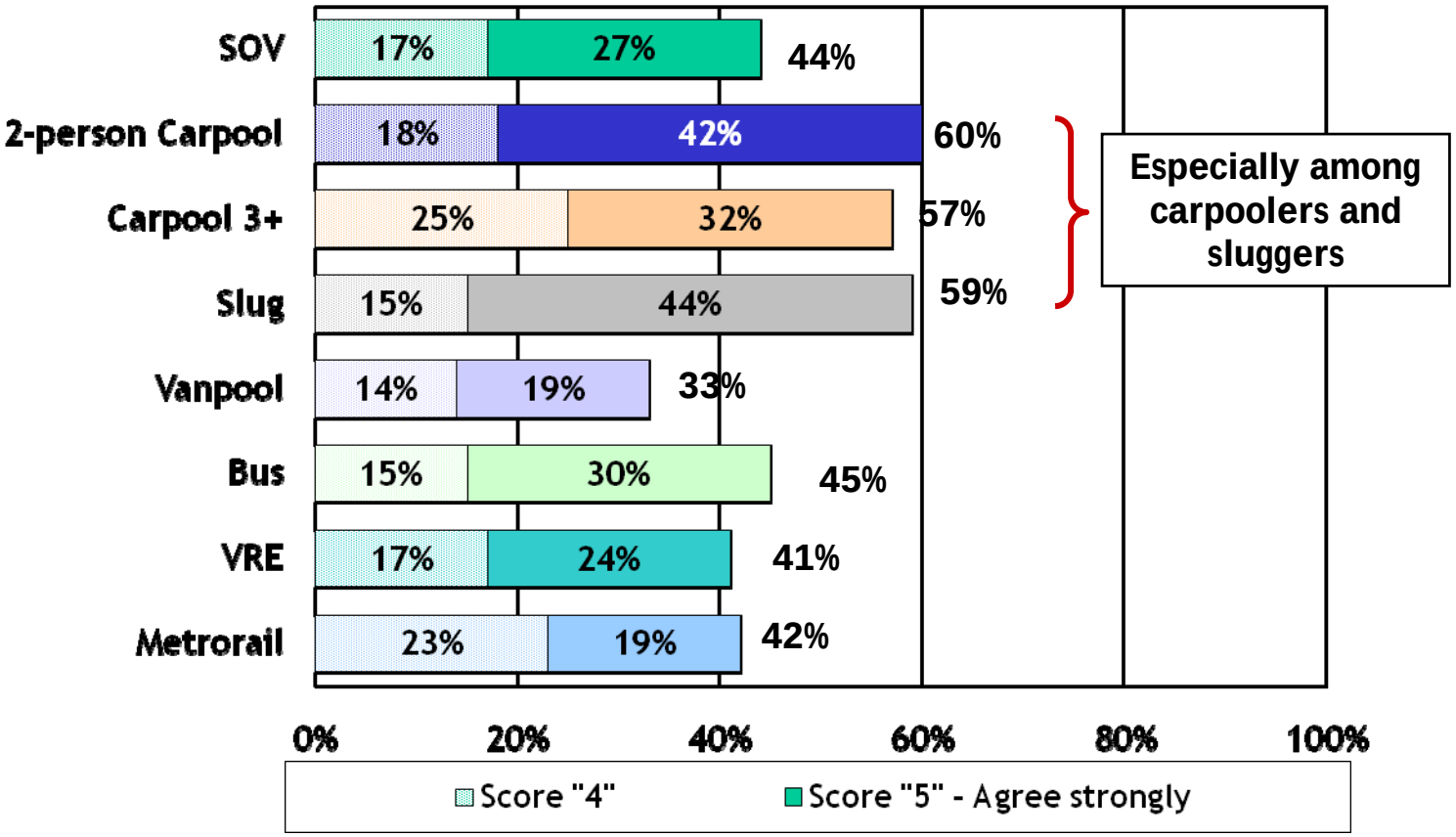
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Slug, n=311
Vanpool, n=137
Bus, n=205
VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# There Is Concern about the Disruption Caused by Construction of the HOT Lanes

*The disruption caused by the construction of HOT lanes will be worse than any eventual benefit*






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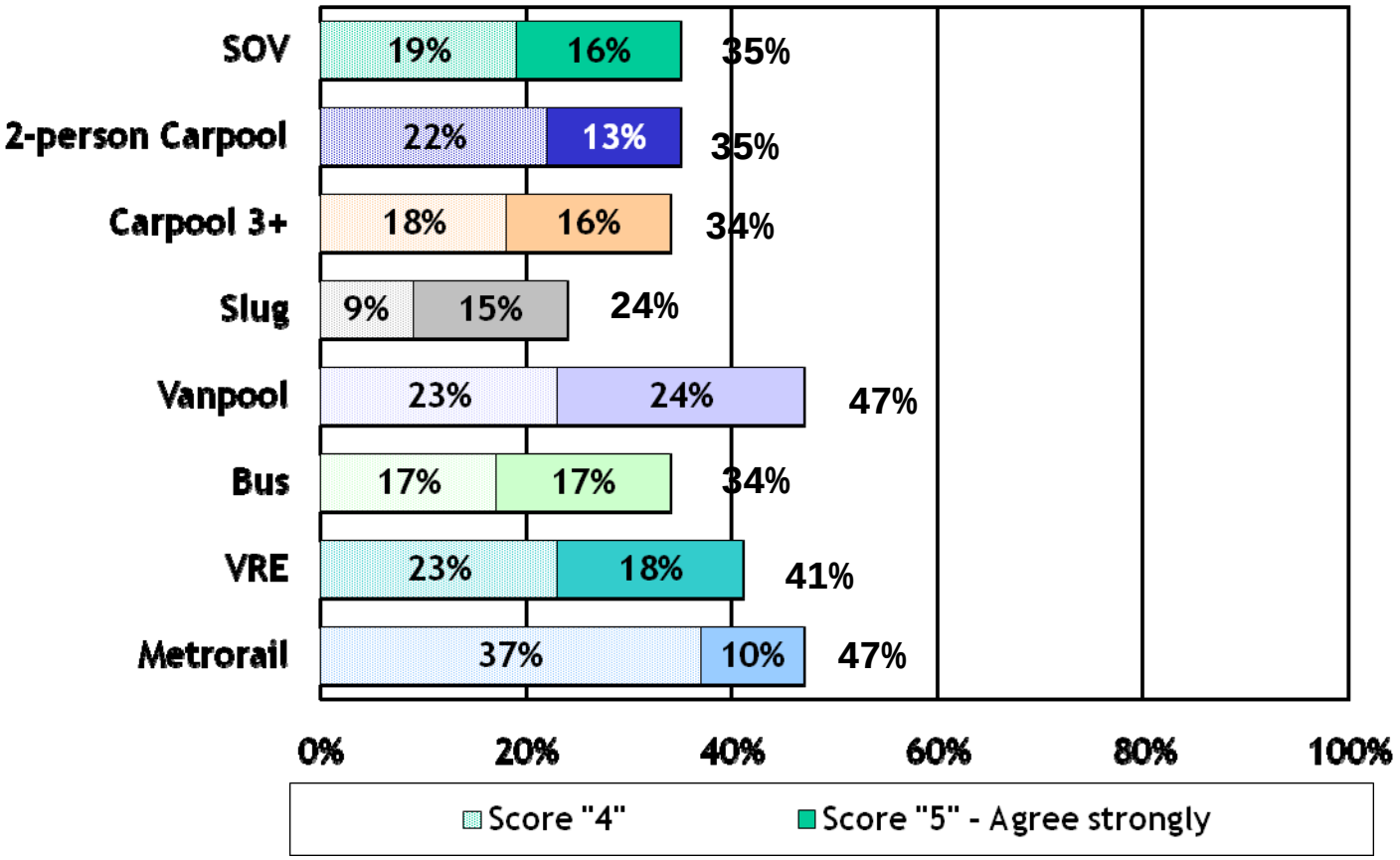
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Slug, n=311
Vanpool, n=137
Bus, n=205
VRE, n=274
Metrorail, n=84

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# A Majority Believe the HOT Lanes Will Not Make Slugging More Attractive, Especially Sluggers and Metrorail Riders

*HOT lanes will encourage drivers to pick up sluggers in order to avoid paying the toll to use the HOT lanes*






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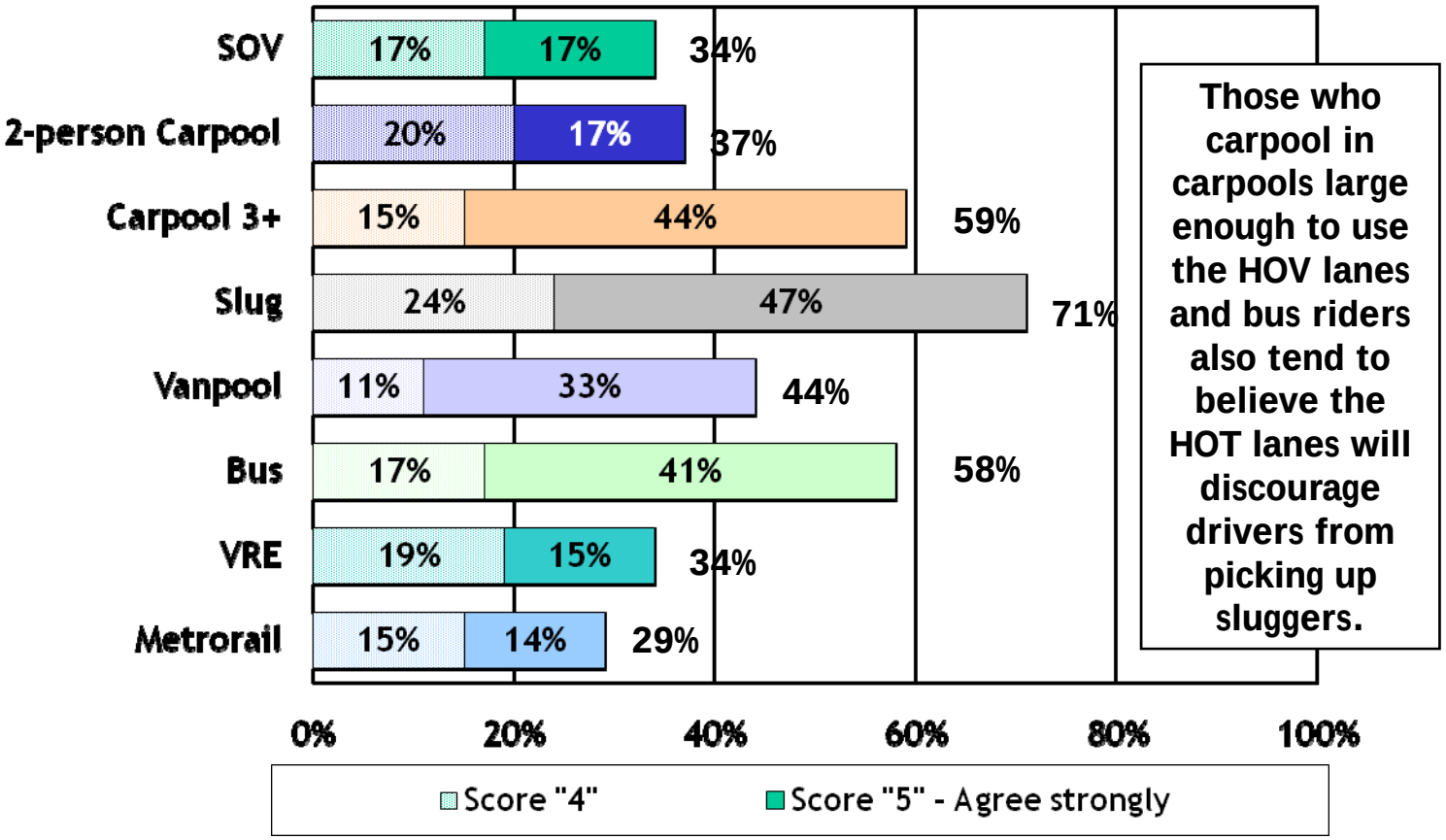
SOV, n=417
2-person carpool, n=71
Carpool 3+, n=117
Slug, n=295
Vanpool, n=131
Bus, n=184
VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# Sluggers Tend to Believe that Drivers Will Pay the HOT Lanes Toll Rather than Pick Up Sluggers

*HOT lanes will discourage drivers from picking up sluggers – drivers will simply pay the toll to use the HOT lanes*




**Those who carpool in carpools large enough to use the HOV lanes and bus riders also tend to believe the HOT lanes will discourage drivers from picking up sluggers.**



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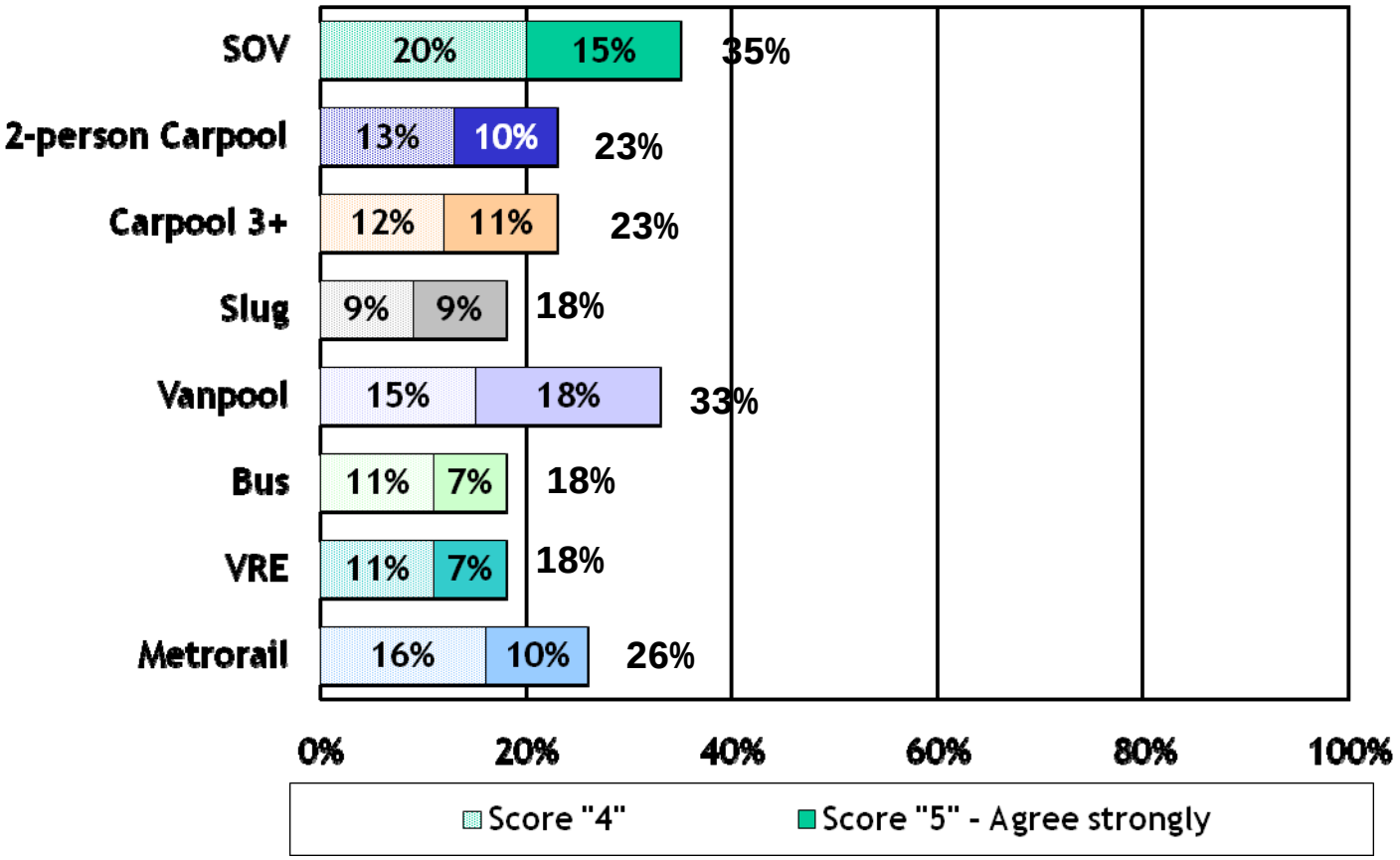
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VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# For the Most Part, Belief that HOT Lanes Are Important for Emergency Evacuation Is Low

*HOT lanes will play a key role in the region's emergency and evacuation plans*






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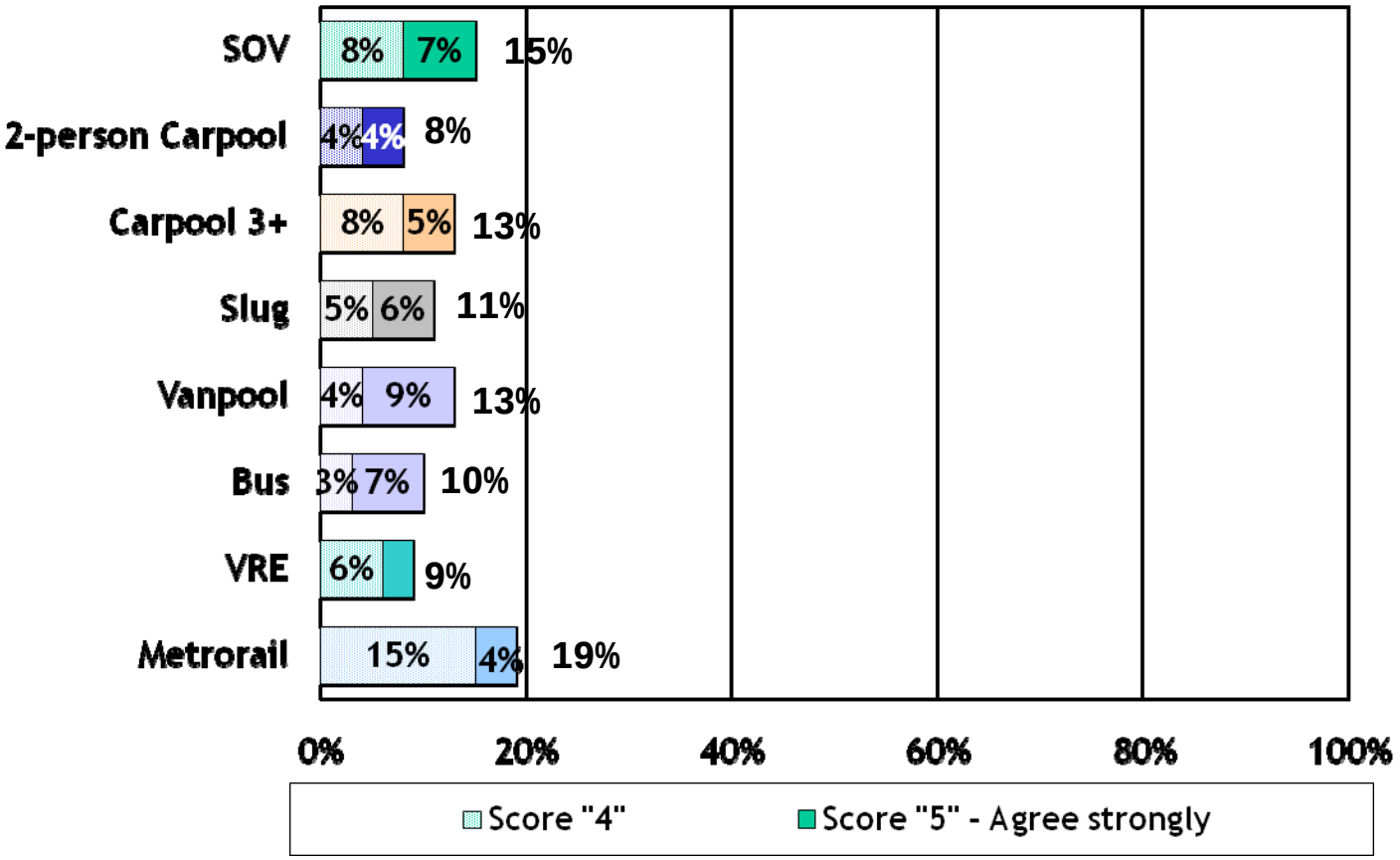
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Bus, n=184
VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# There Is Little Appreciation that HOT Lanes Will Help the Environment

*HOT lanes will benefit the environment because there will be fewer vehicles on the road and, thus, reduced vehicle emissions*






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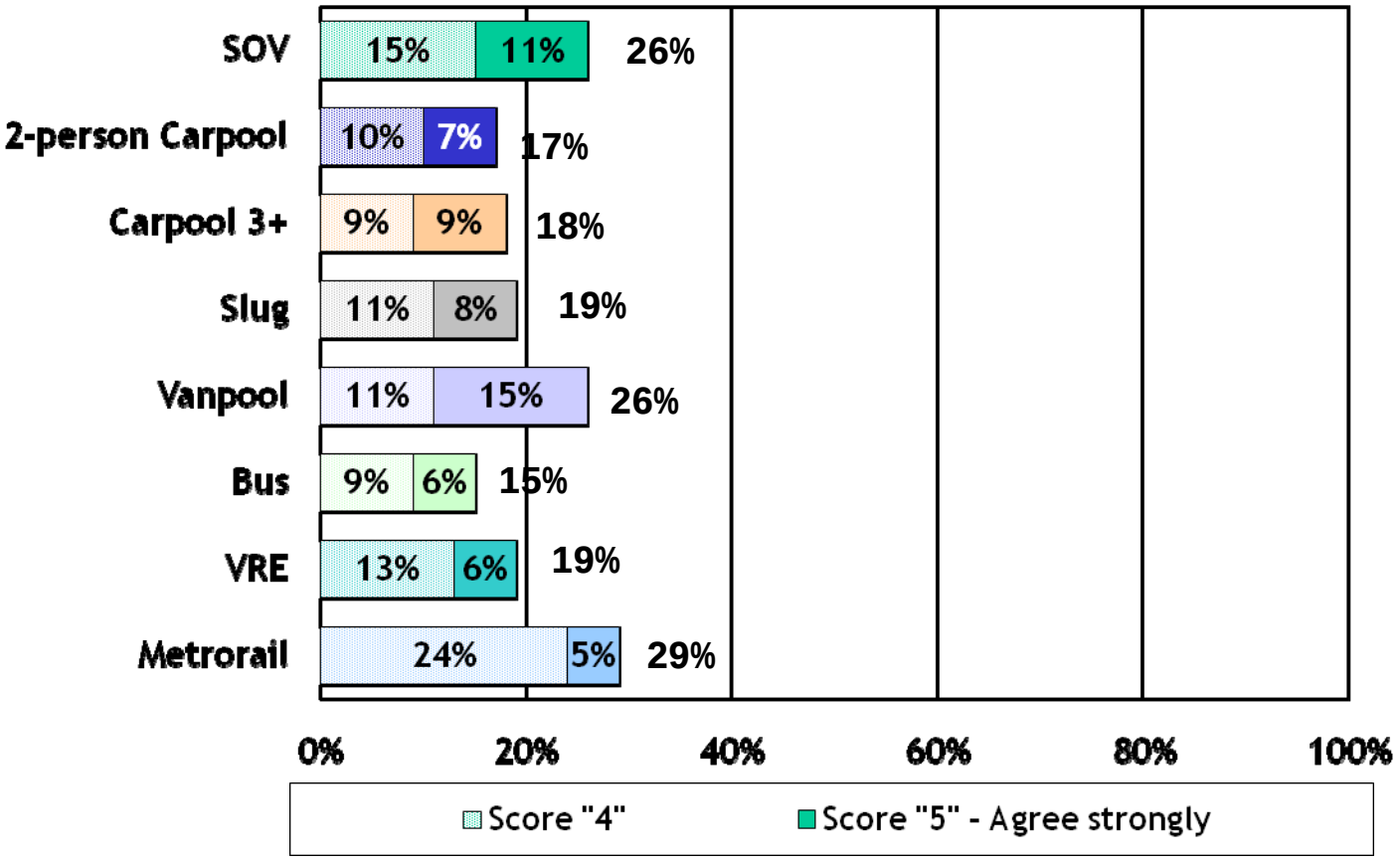
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Slug, n=295
Vanpool, n=131
Bus, n=184
VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# Belief that HOT Lanes Will Support the Economy Is Fairly Low

*HOT lanes will help I-95/I-395 to support the region's economic vitality*






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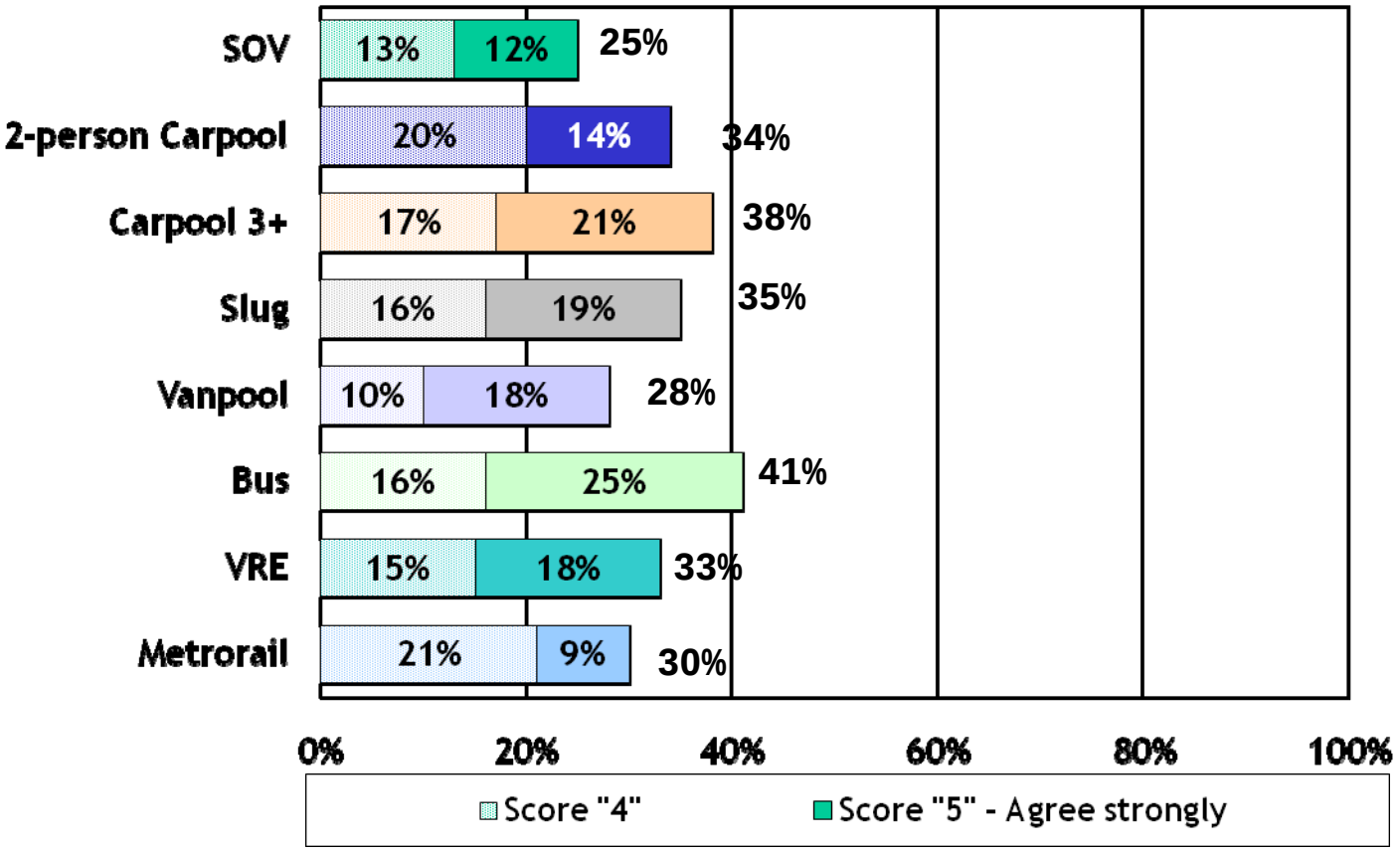
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Carpool 3+, n=117
Slug, n=295
Vanpool, n=131
Bus, n=184
VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# 41% of Bus Riders Believe HOT Lanes Will Bring too Much Growth and Development – 25% of SOVers Express this Concern

*HOT lanes will add too much growth and development to the area*






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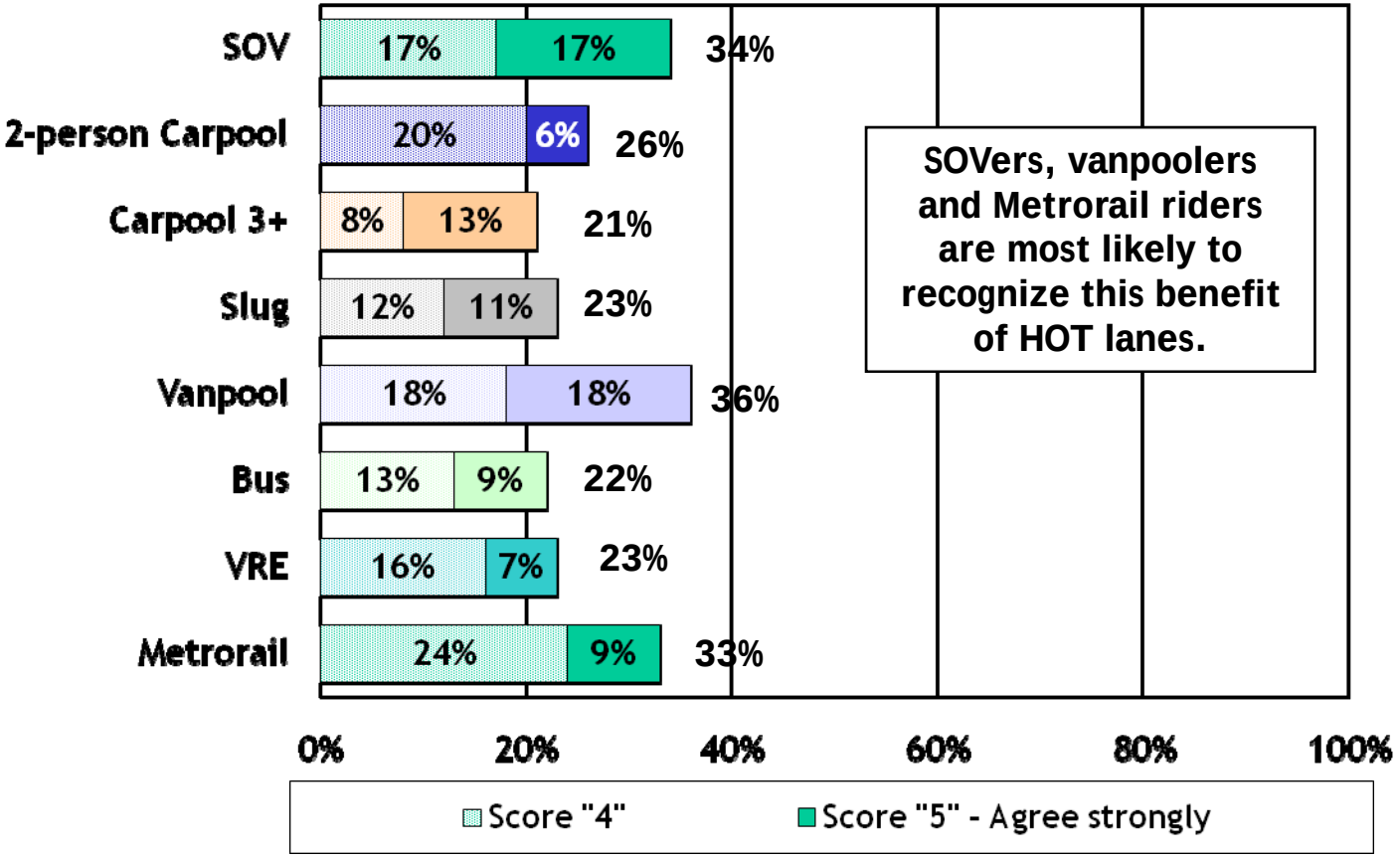
SOV, n=417
2-person carpool, n=71
Carpool 3+, n=117
Slug, n=295
Vanpool, n=131
Bus, n=184
VRE, n=227
Metrorail, n=101

**Question asked of half of respondents.**

Q38. Next is a list of statements about HOT lanes. Please indicate the extent to which you agree or disagree with each statement.

# For the Most Part, Commuters Do Not Seem to Believe that HOT Lanes Will Cut Commute Time and Allow More Time to Enjoy Life

*HOT lanes will help commuters be able to spend less time commuting and more time doing things they enjoy*






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# Commuters from Prince William County Tend to View the HOT Lanes More Negatively – Especially Carpoolers and Sluggers. Spotsylvania/Stafford Residents Are More Likely to See the Positives – Especially Vanpoolers

| SOV | | | Carpool of 3 or more | | | Slug | | | Vanpool | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N. Vir. | P. Will. | Spots/ Staff. | N. Vir. | P. Will. | Spots/ Staff. | N. Vir. | P. Will. | Spots/ Staff. | N. Vir. | P. Will. | Spots/ Staff. |
| *HOT lanes will help traffic to flow faster in the existing HOV lanes* | | | | | | | | | | | |
| 25% | 27% | 30% | 23% | 3% | 27% | 13% | 4% | 25% | NA | 26% | 43% |
| *HOT lanes will help commuters save time on their commutes* | | | | | | | | | | | |
| 35% | 31% | 41% | 35% | 8% | 39% | 17% | 7% | 29% | NA | 38% | 49% |
| *HOT lanes will discourage drivers from picking up sluggers* | | | | | | | | | | | |
| 34% | 39% | 23% | 57% | 76% | 32% | 69% | 77% | 61% | NA | 56% | 40% |

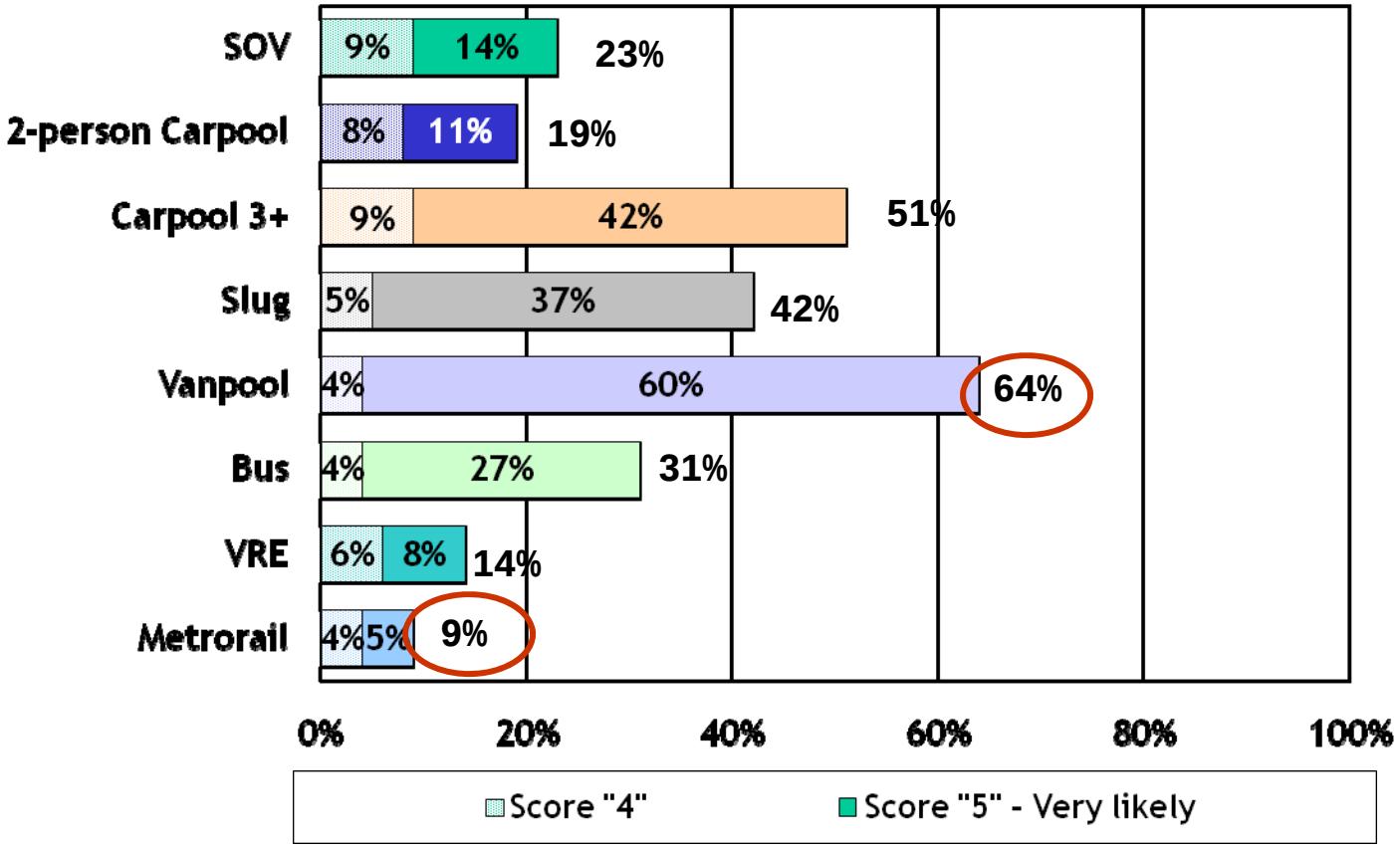
**Note: Proportions reported are total scores of "4" and "5" on a 5-point scale where "1" means "disagree strongly" and "5" means "agree strongly."**

**The list of attributes/benefits tested was divided in half so that each respondent was asked about half of the list. Thus, base sizes vary by location, mode, and attribute. Results for vanpoolers who live in Northern Virginia are not reported due to small base size.**

# Stated Interest in Using the HOT Lanes Is Highest among Vanpoolers (64%) and Those Commuting in Carpools of 3 or More (51%) and Lowest among Metrorail Riders (9%)

**Question asked of all respondents.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute?



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# Likelihood of Using the HOV Lanes Is Highest among Commuters from Spotsylvania and Stafford Counties

| *Likelihood of Using HOT lanes* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SOV** | | | | **Carpool of 3 or more** | | | | **Slug** | | | | **Vanpool** | |
| **N. Vir.** | **P. Will.** | **Spots/ Staff.** | | **N. Vir.** | **P. Will.** | **Spots/ Staff.** | | **N. Vir.** | **P. Will.** | **Spots/ Staff.** | | **N. Vir.*** | **P. Will.** | **Spots/ Staff.** |
| n=473 | n=183 | n=156 | | n=79 | n=86 | n=65 | | n=109 | n=309 | n=180 | | - | n=66 | n=191 |
| 20% | 27% | 32% | | 39% | 43% | 76% | | 33% | 34% | 63% | | NA | 47% | 72% |

**Response to question does not provide information about mode change or intent to pay toll.**

**Note: Proportions reported are total scores of "4" and "5" on a 5-point scale where "1" means "not at all likely" and "5" means "very likely."**

***Vanpool for Northern Virginia not reported due to small base size.**

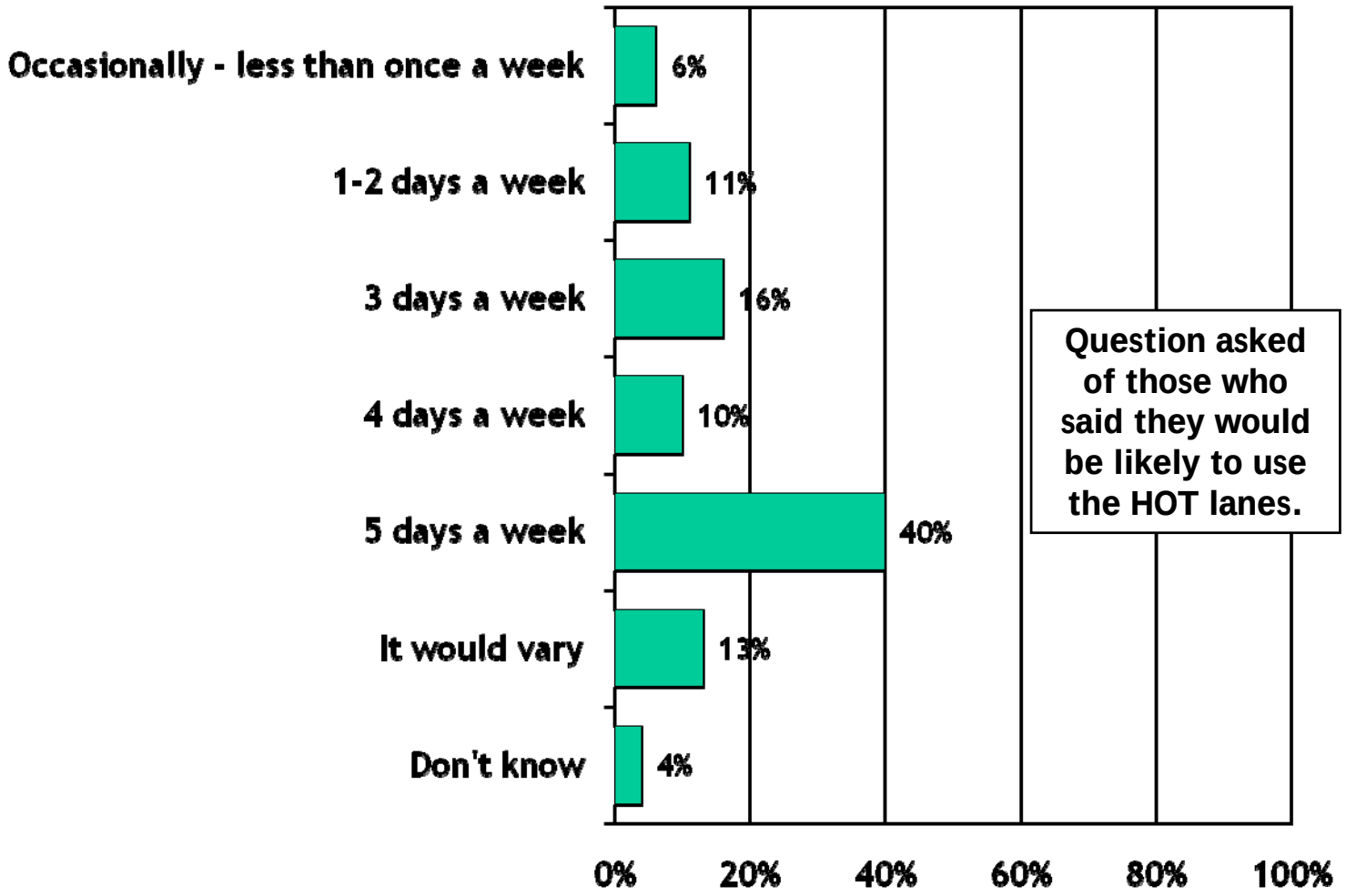
Q39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute?

n=193

# SOVers Who Would Use the HOT Lanes Would Most Often Use Them Everyday – or at Least 3 or 4 Days a Week

**Proportions shown represent SOVers.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q40. How often would you use the HOT lanes during the week, Monday through Friday?



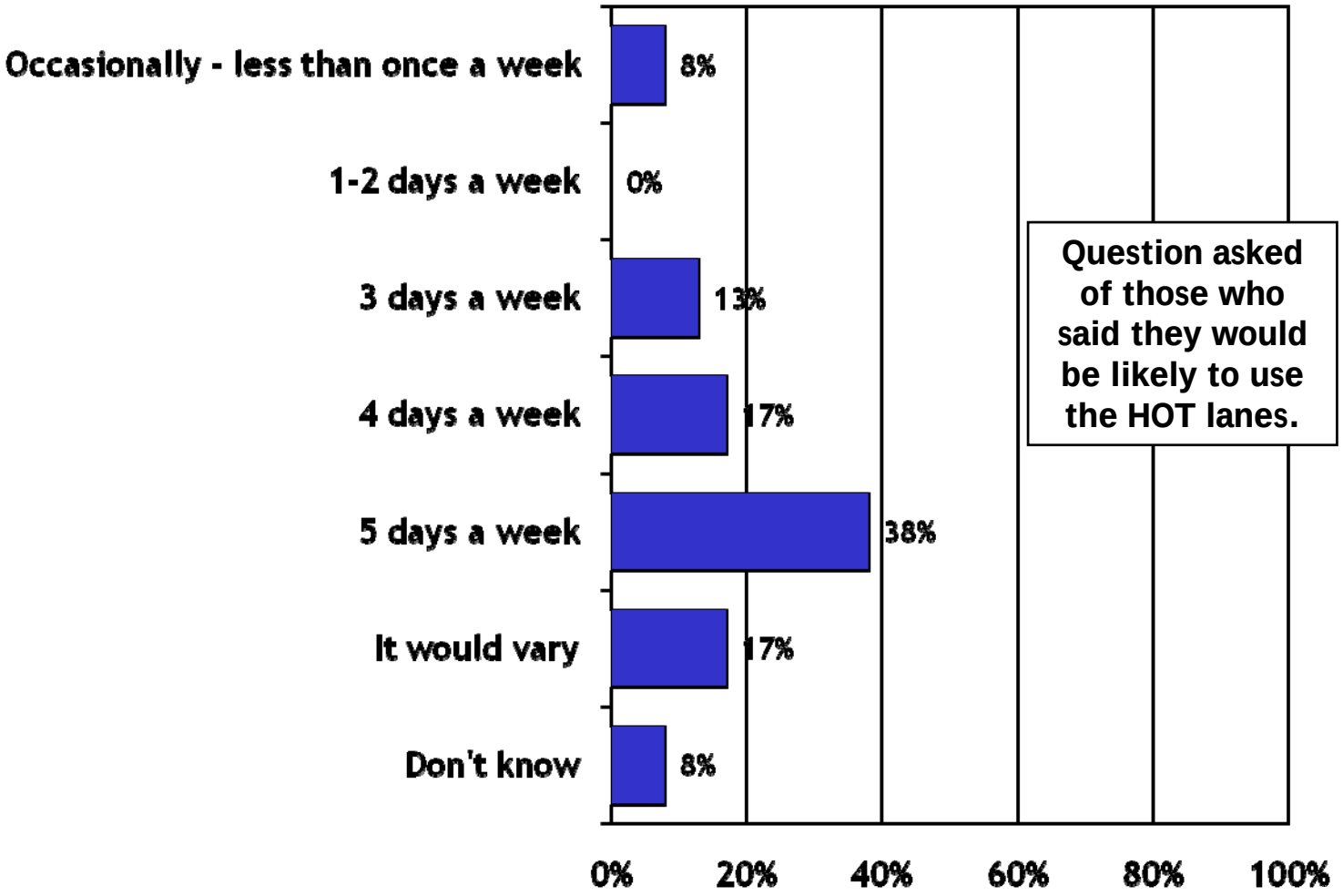
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n=24
Base size small. Interpret with caution.

# About One-third of Those Who Currently Commute in a Carpool of 2 Persons and Would Likely Use the HOT Lanes Would Use the Lanes 5 Days a Week

**Proportions shown represent commuters in 2-person carpools.**

**Response to question does not provide information about mode change or intent to pay toll.**



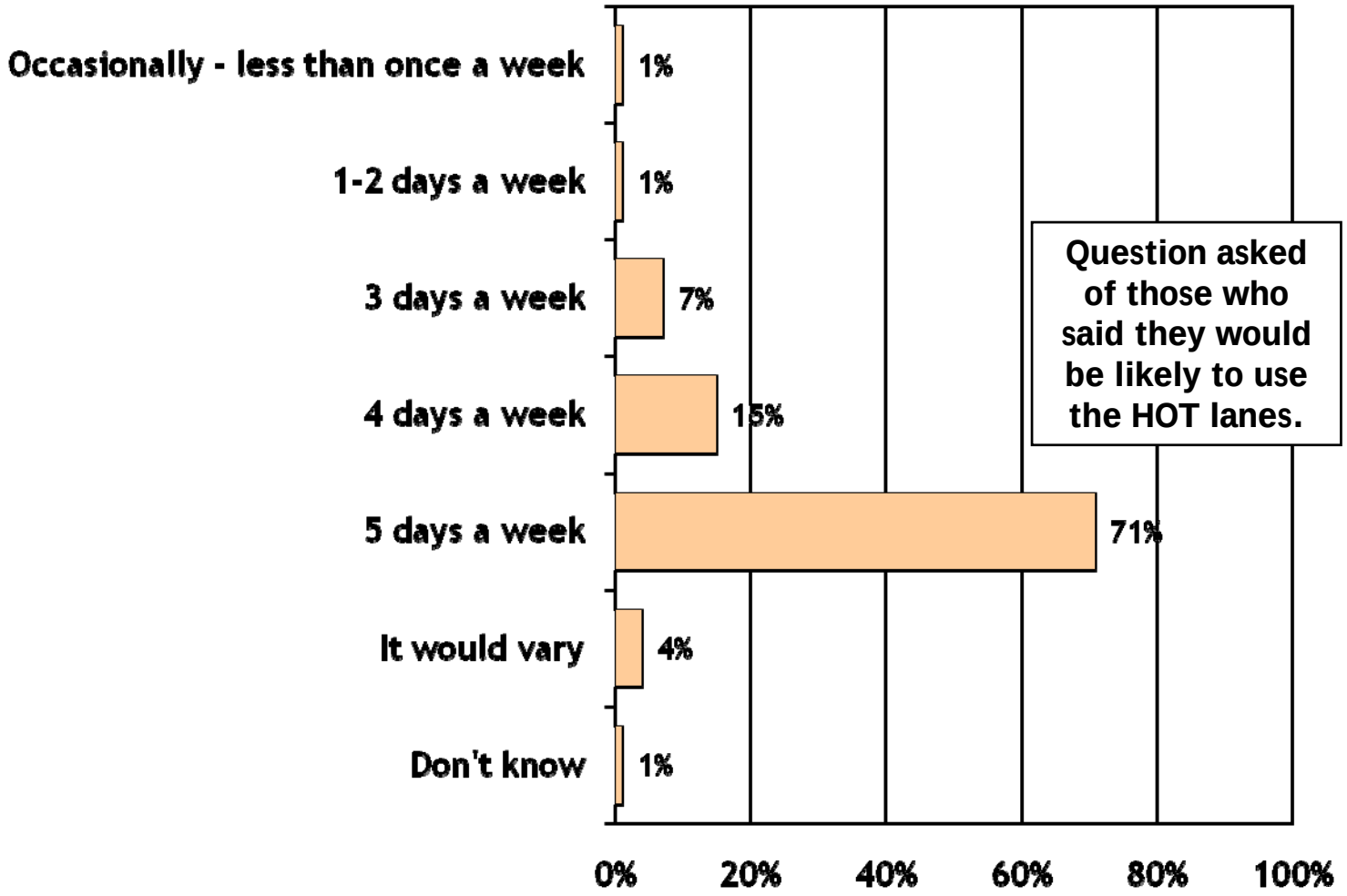

Q40. How often would you use the HOT lanes during the week, Monday through Friday?



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n=117

# Those Who Currently Commute in a Carpool of 3 or More Persons and Would Use the HOT Lanes Are Nearly Twice as Likely to Use the HOT Lanes 5-days a Week as those Who Currently Commute in a Carpool of Only 2 Persons




Proportions shown represent commuters in carpools of 3 or more.

Response to question does not provide information about mode change or intent to pay toll.

Q40. How often would you use the HOT lanes during the week, Monday through Friday?



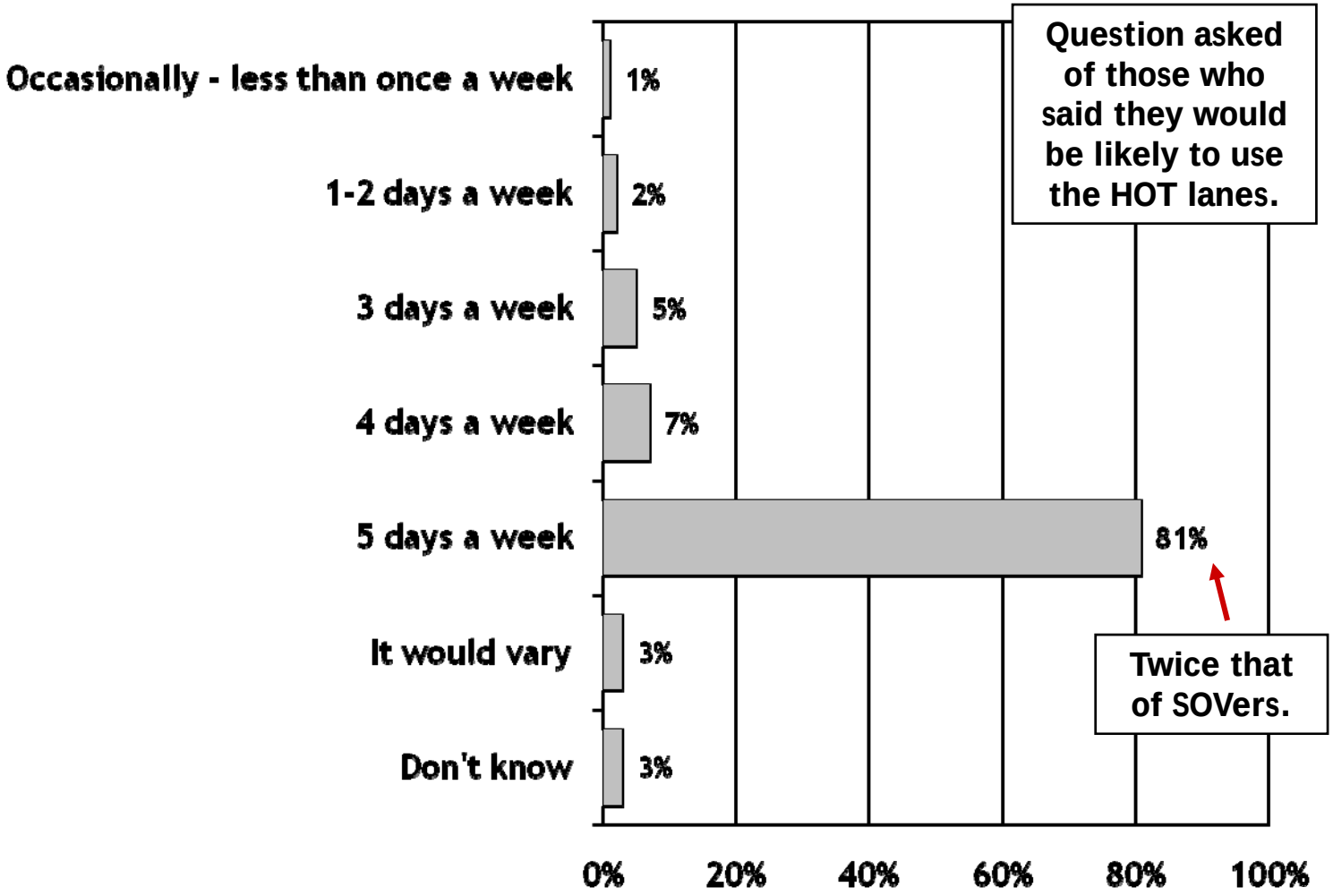
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n=258

# Of Sluggers Who Would Likely Use the HOT Lanes, 81% Would Use the Lanes 5 Days a Week

**Proportions shown represent sluggers.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q40. How often would you use the HOT lanes during the week, Monday through Friday?



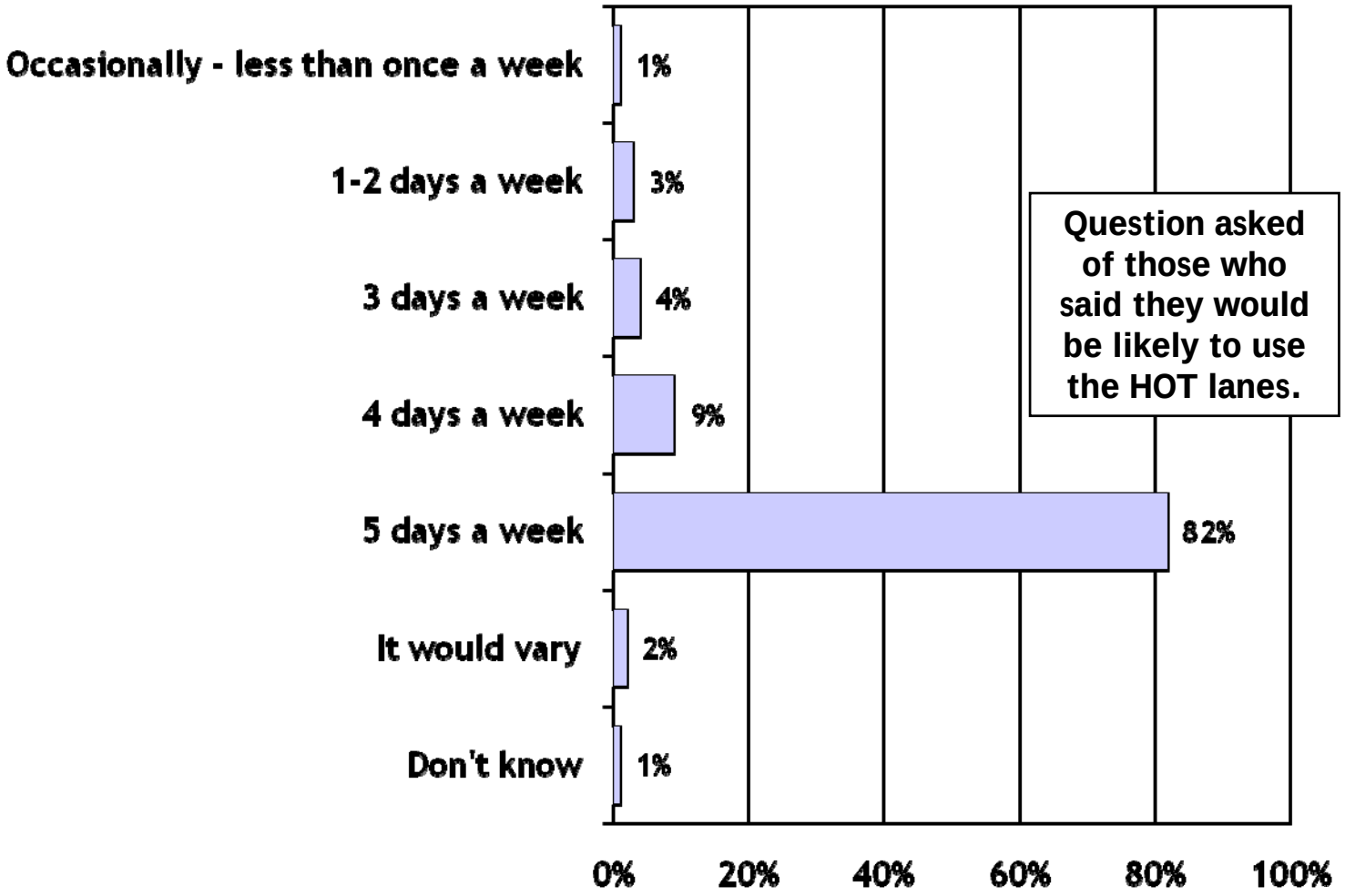
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n=173

# Vanpool HOT Lanes Users Would Also Be Regular Users

**Proportions shown represent vanpoolers.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q40. How often would you use the HOT lanes during the week, Monday through Friday?



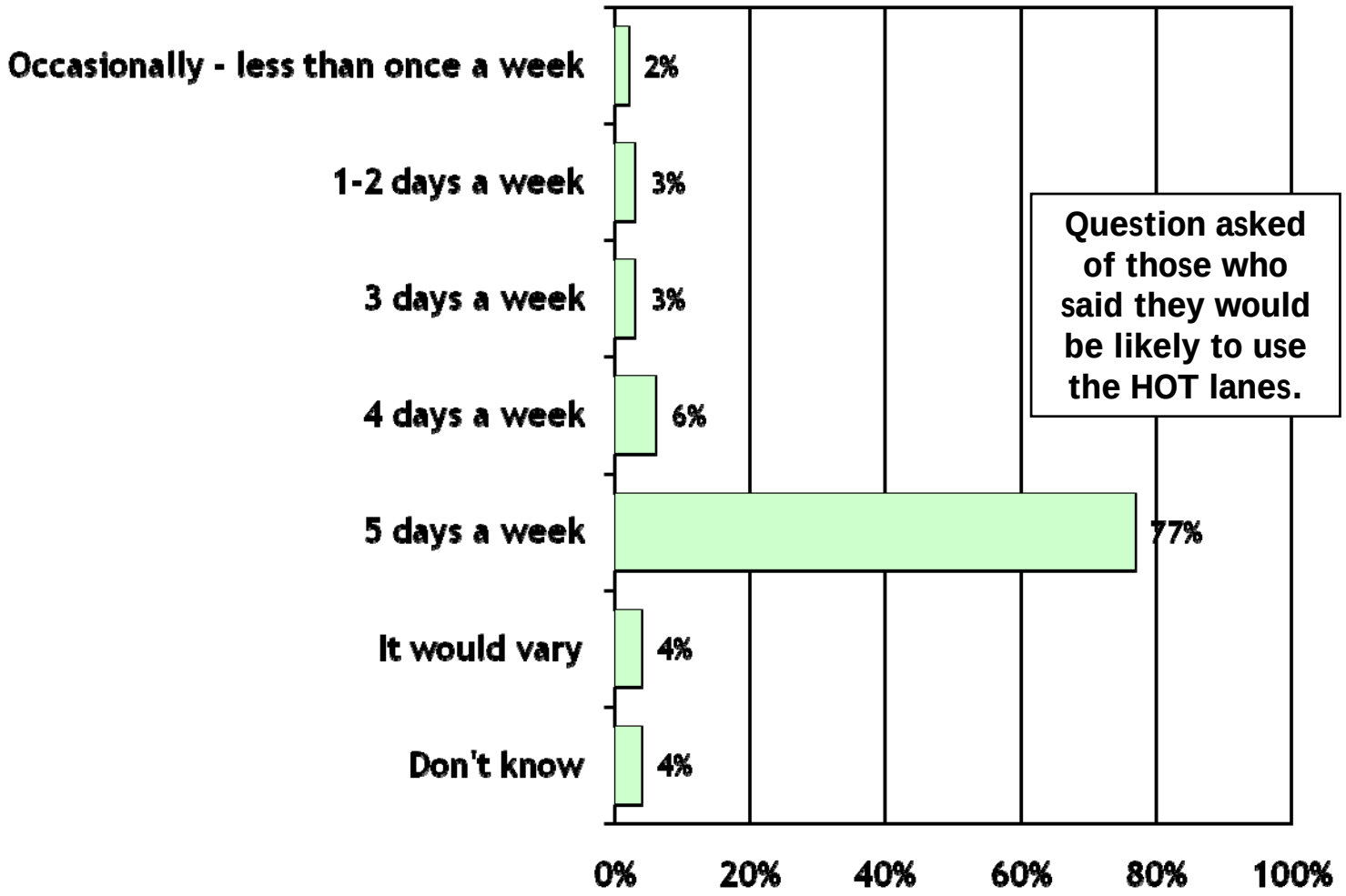
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n=119

# Bus Riders Who Would Likely Use the HOT Lanes Would Be Regular Users

**Proportions shown represent bus riders.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q40. How often would you use the HOT lanes during the week, Monday through Friday?



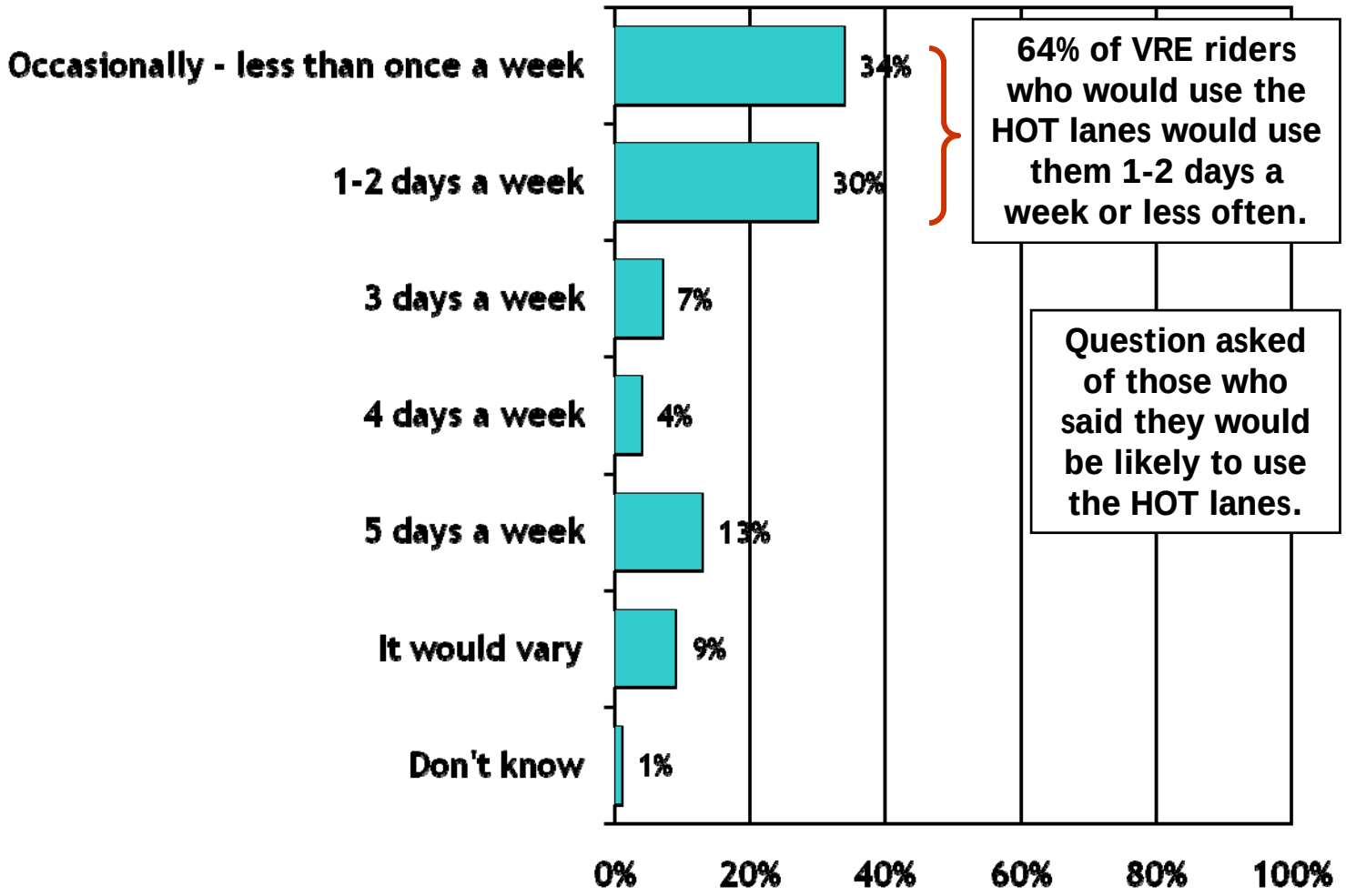
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n=70

# VRE Riders Would Be Less Frequent Users of the HOT Lanes

**Proportions shown represent VRE riders.**

**Response to question does not provide information about mode change or intent to pay toll.**




Q40. How often would you use the HOT lanes during the week, Monday through Friday?



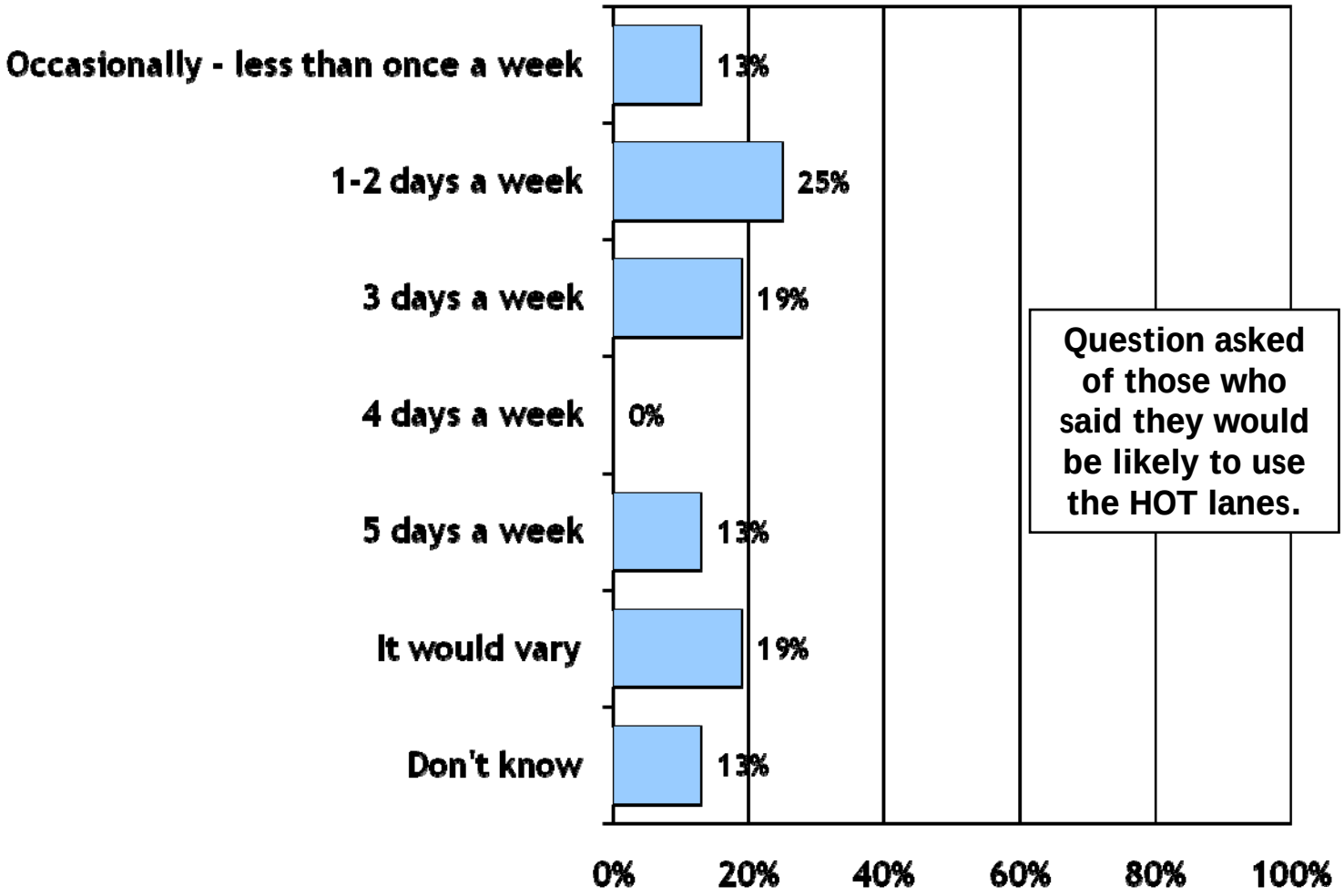
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n=17
Base size small. Interpret with caution.

**Proportions shown represent Metrorail riders.**

**Response to question does not provide information about mode change or intent to pay toll.**

# There Is No Consistent Pattern of Intended HOT Lane Use among Metrorail Riders Who Would Use the HOT Lanes




Q40. How often would you use the HOT lanes during the week, Monday through Friday?

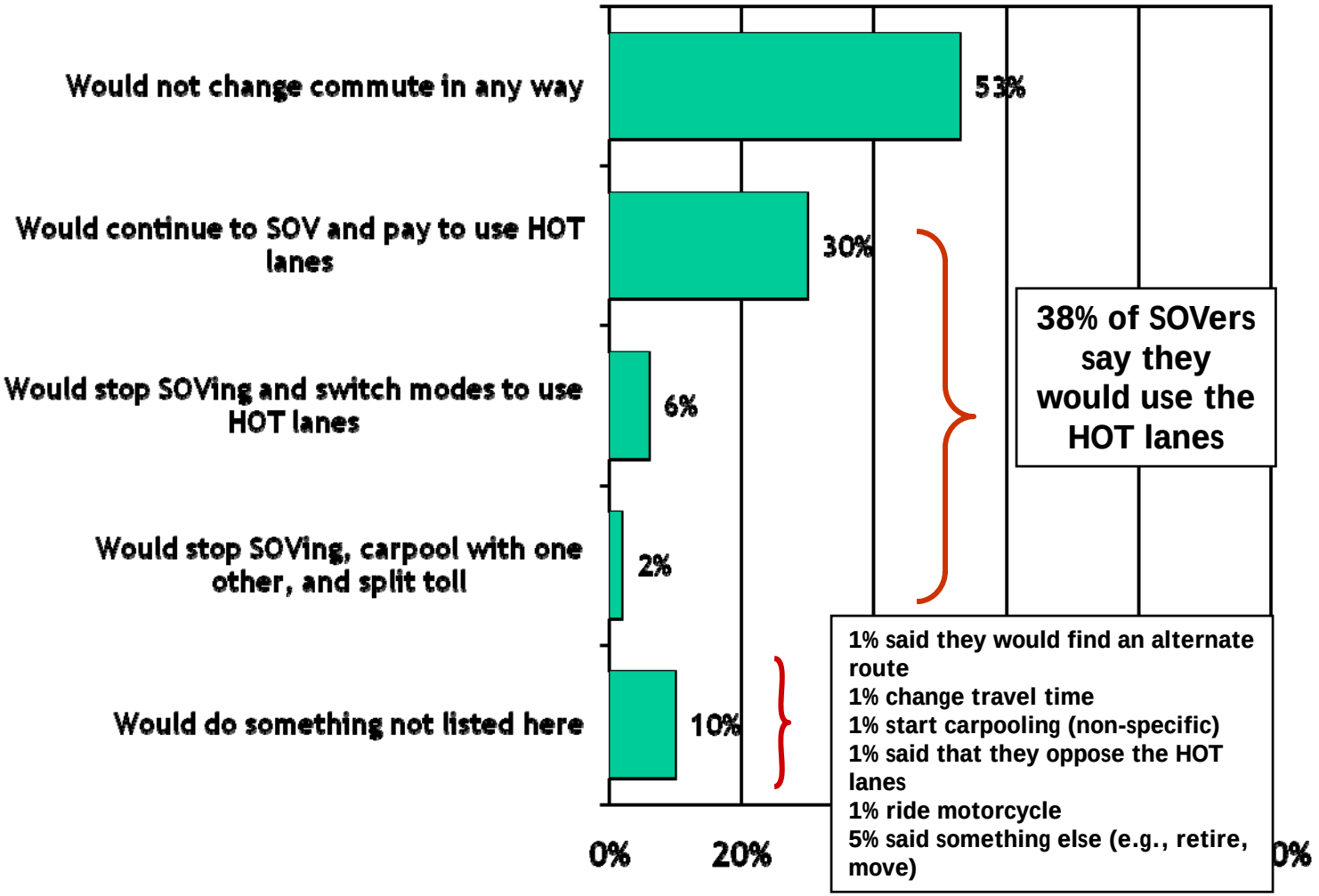


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# About Half of SOVers Say They Would Make No Changes in Their Commutes When the HOT Lanes are Open

**Proportions shown represent SOVers.**

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



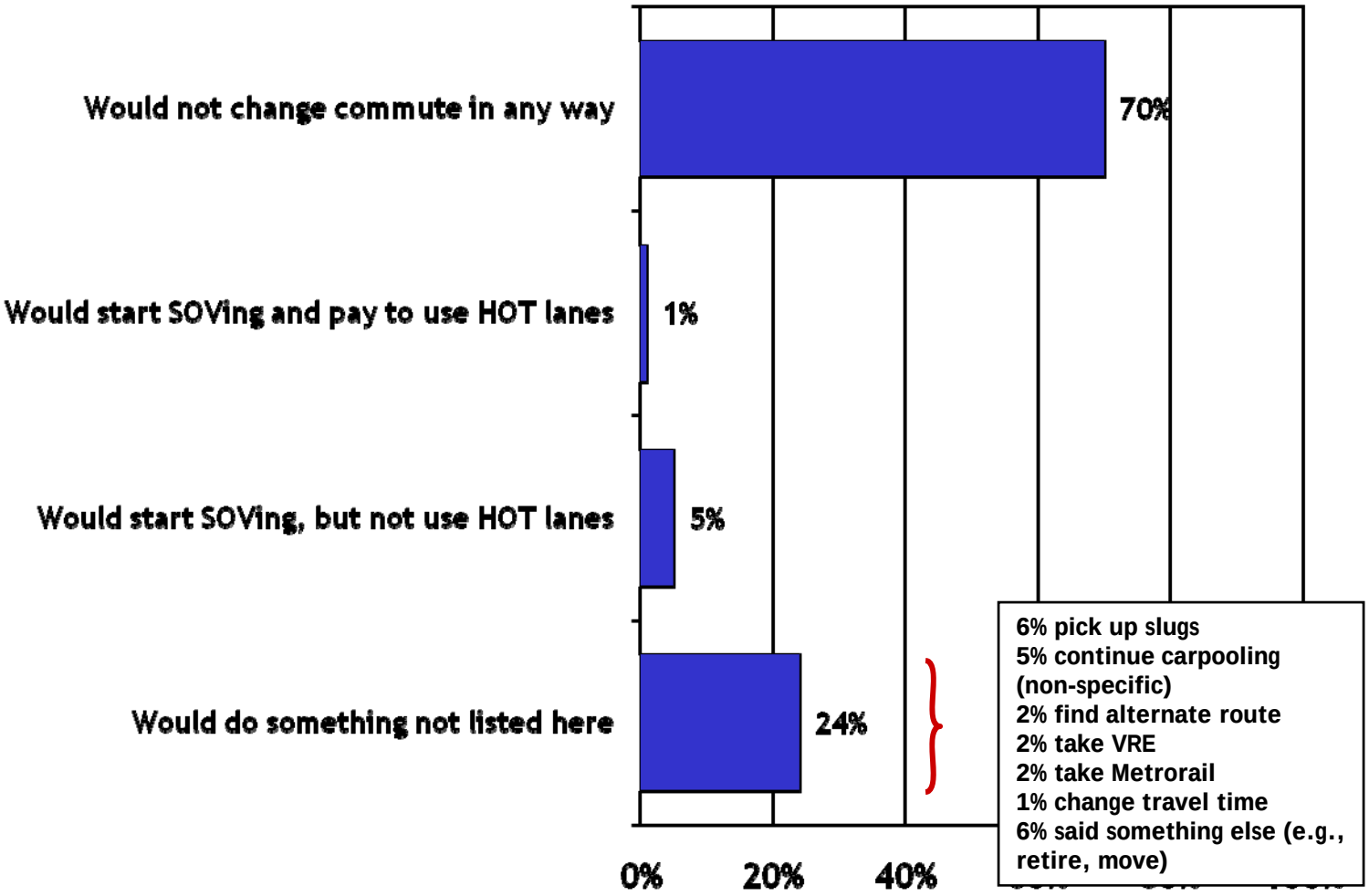



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# Most Carpoolers Who Commute in 2-Person Carpools Would Not Change their Commute in Response to HOT Lanes

**Proportions shown represent 2-person carpool commuters.**

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



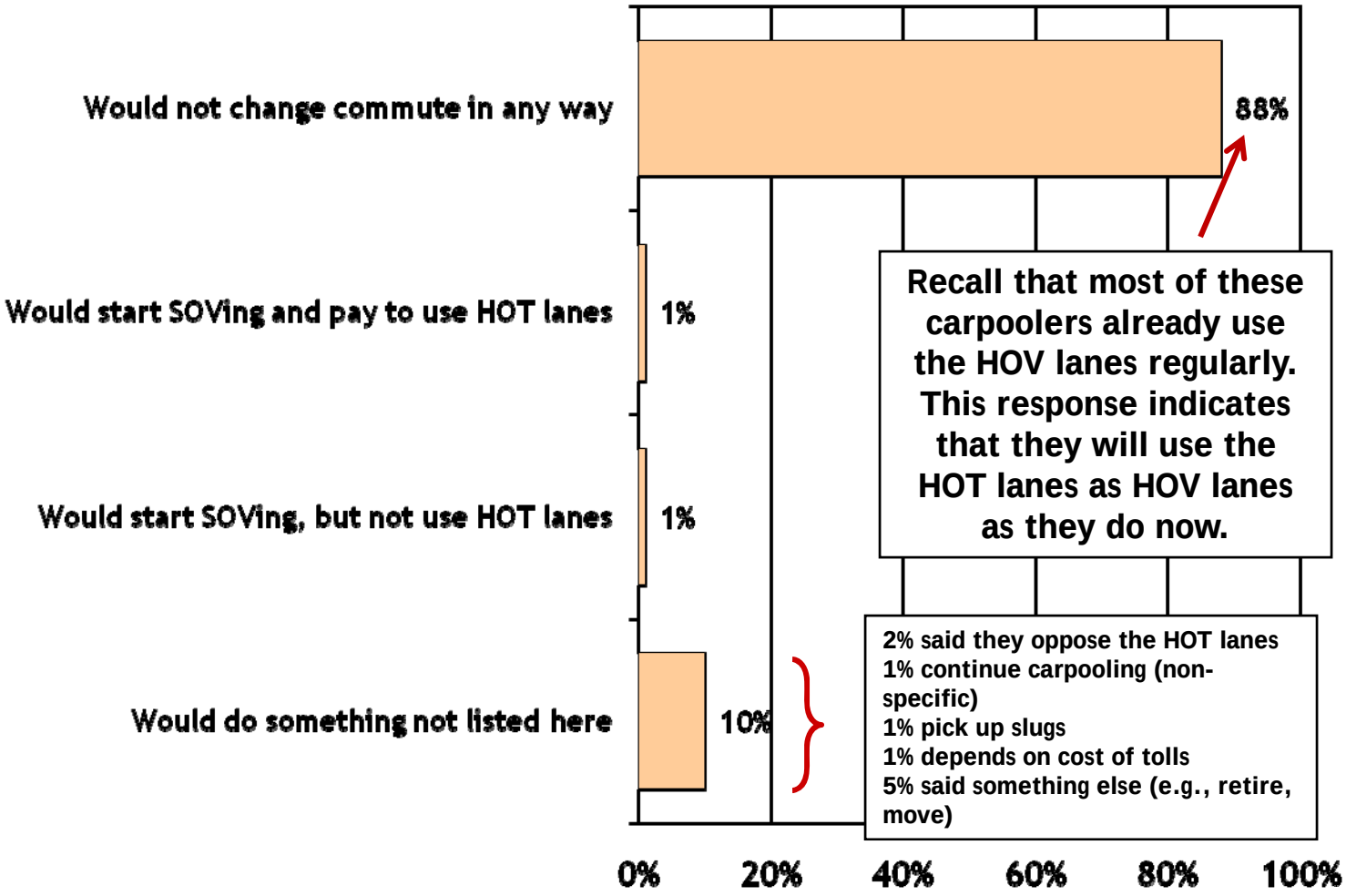



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# Most Carpoolers Who Commute in Carpools of 3 or More Persons Would Not Change their Commute in Response to HOT Lanes

**Proportions shown represent commuters in carpools of 3 or more.**

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



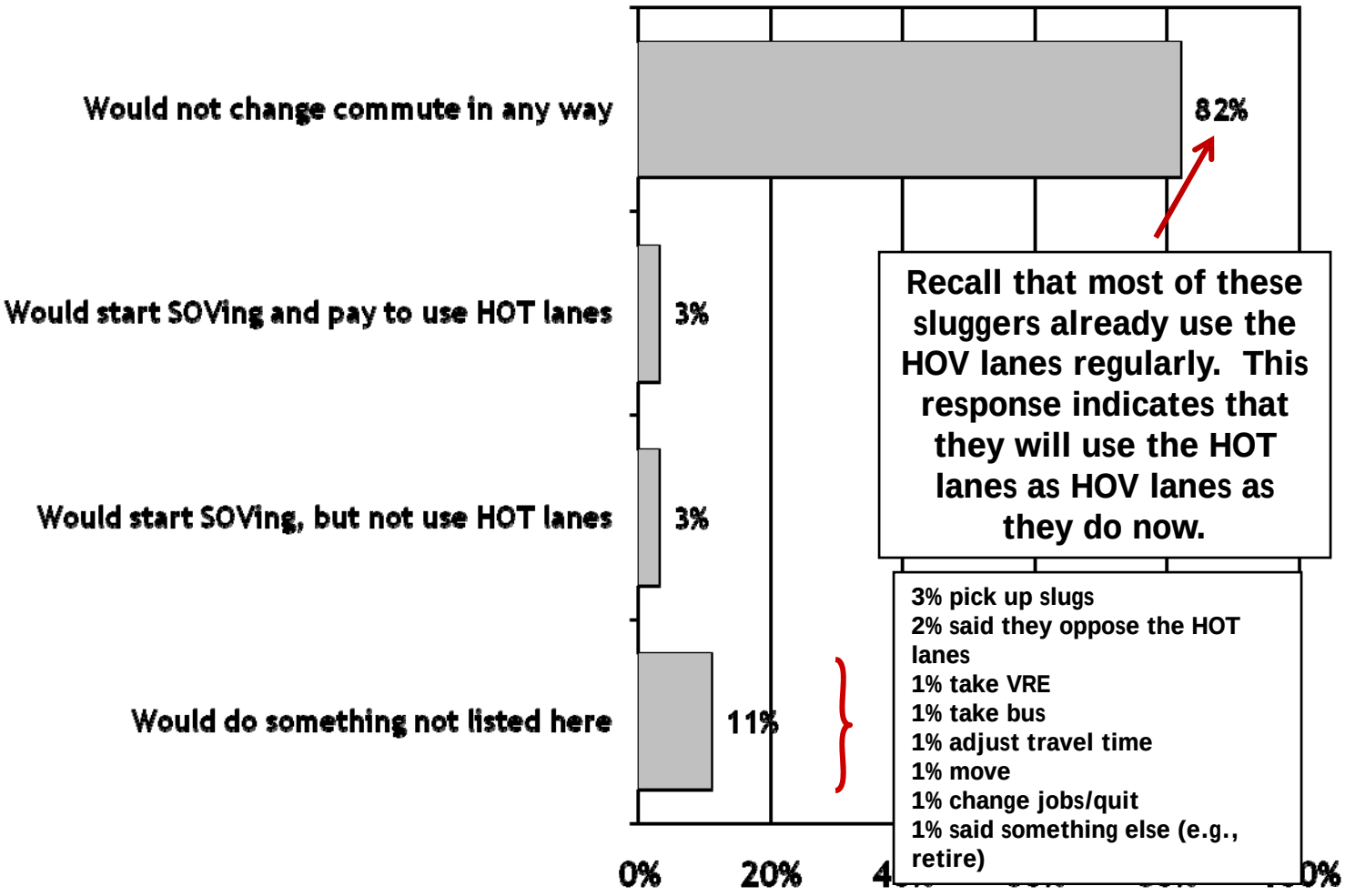



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# For the Most Part, Sluggers Would Continue to Slug if HOT Lanes Were Available

**Proportions shown represent sluggers.**

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



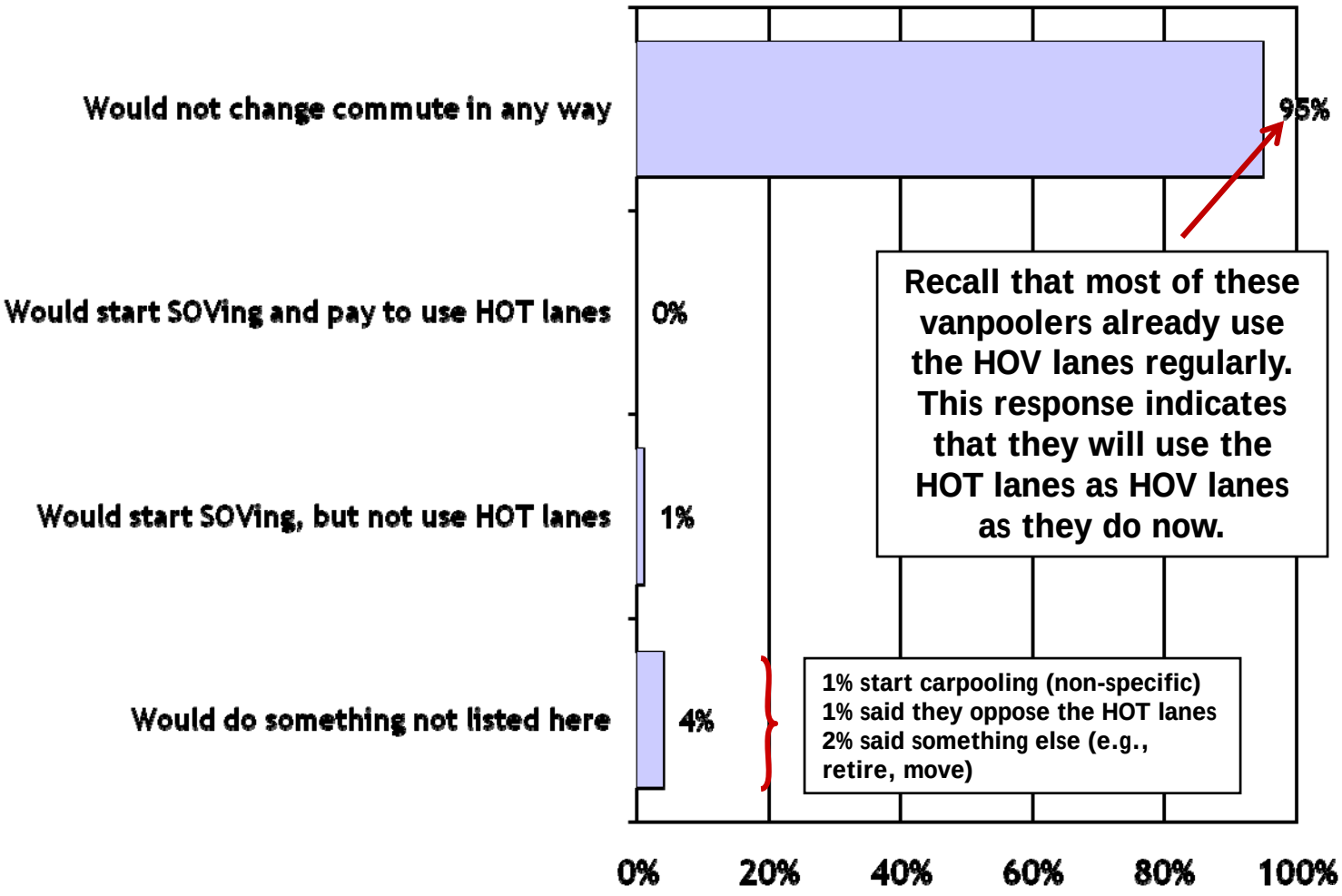



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# Vanpoolers Would Not Change their Commute Behavior in Response to HOT Lanes

**Proportions shown represent vanpoolers.**

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?

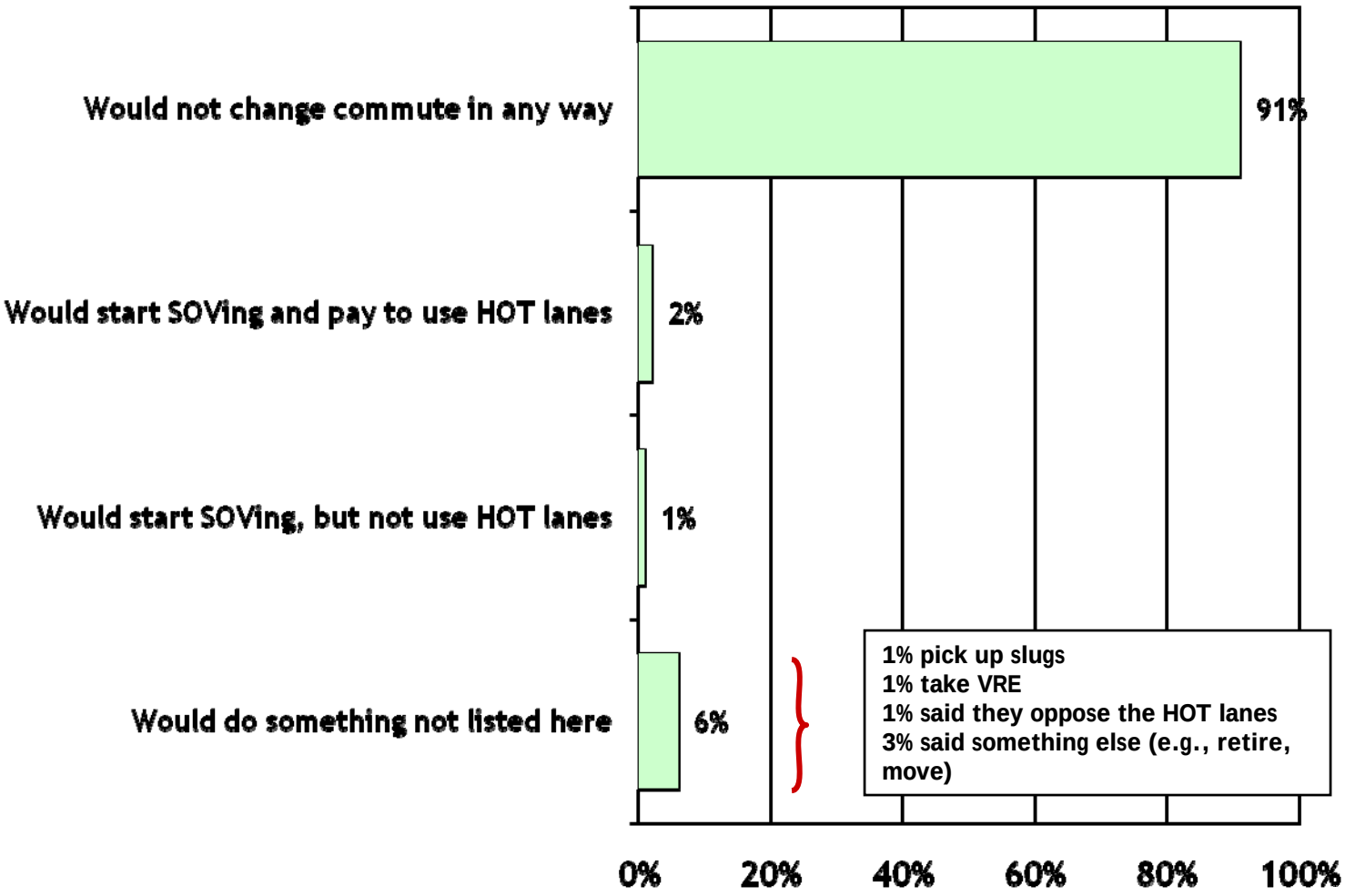





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# Bus Riders Also Say They Would Not Change How They Commute in Response to HOT Lanes

**Proportions shown represent bus riders.**



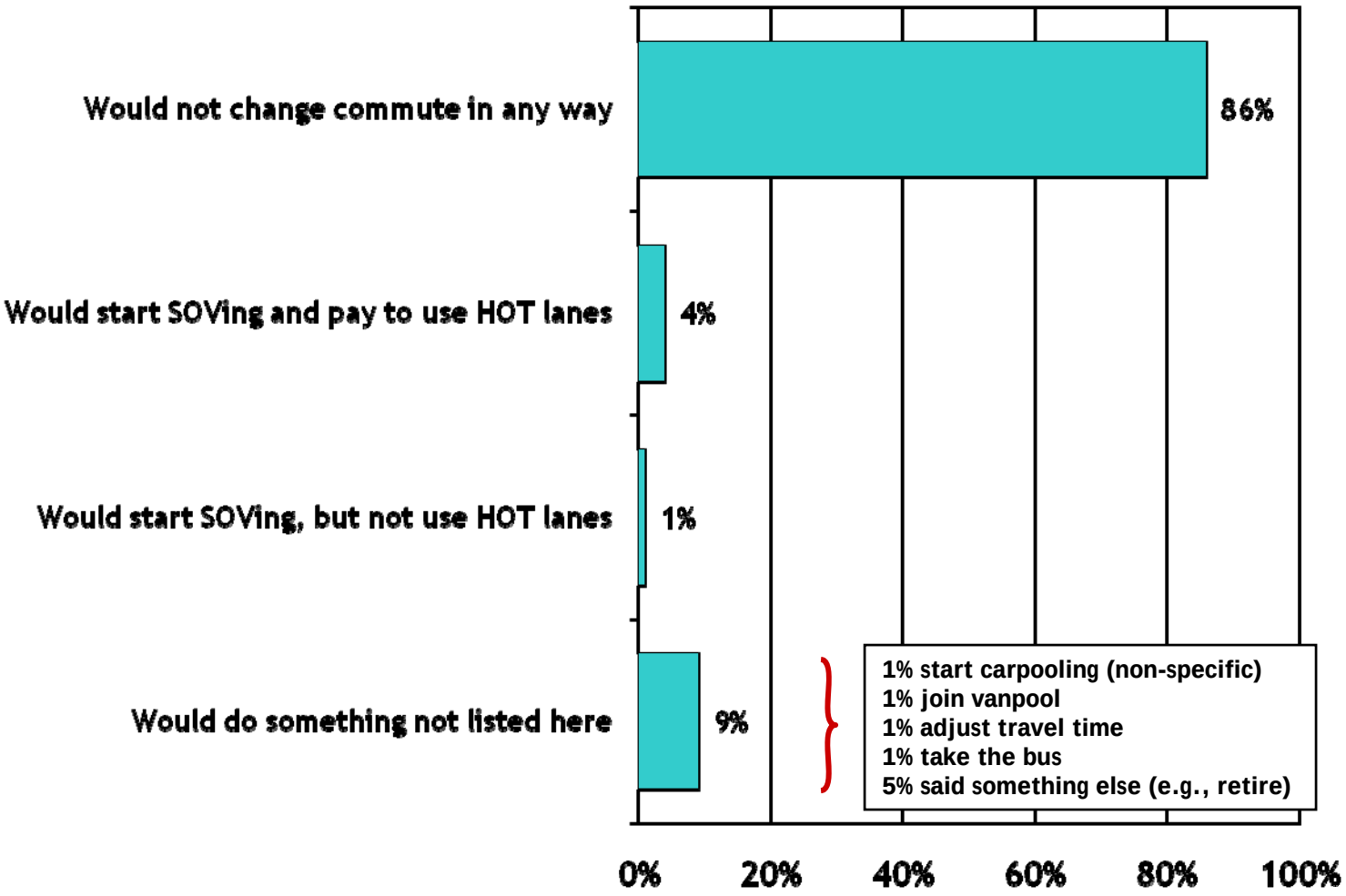

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



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# For the Most Part, VRE Riders Would Continue to Ride the Train

**Proportions shown represent VRE riders.**



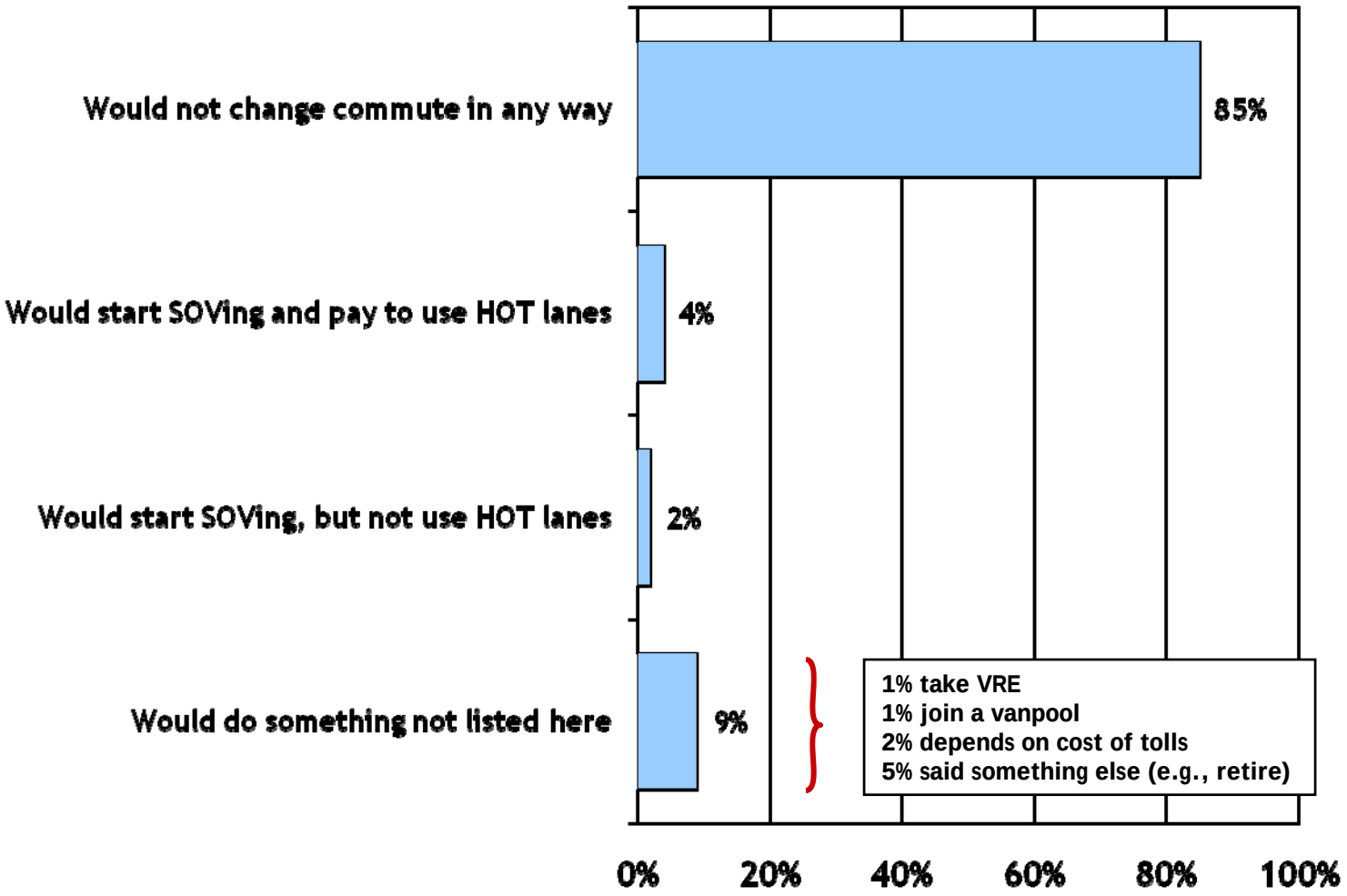

Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



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# For the Most Part, Metrorail Riders Would Continue to Ride Metrorail

**Proportions shown represent Metrorail riders.**




Q41A-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use?



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# Outline of Report

*I. Profile of Commuters*

*II. HOT Lanes*

*III. Transit and TDM Improvements*

- Express Bus
- VRE
- Metrorail

- Park-and-ride
- Bus Rapid Transit
- Online Ride-matching

# Demand Discount Factor

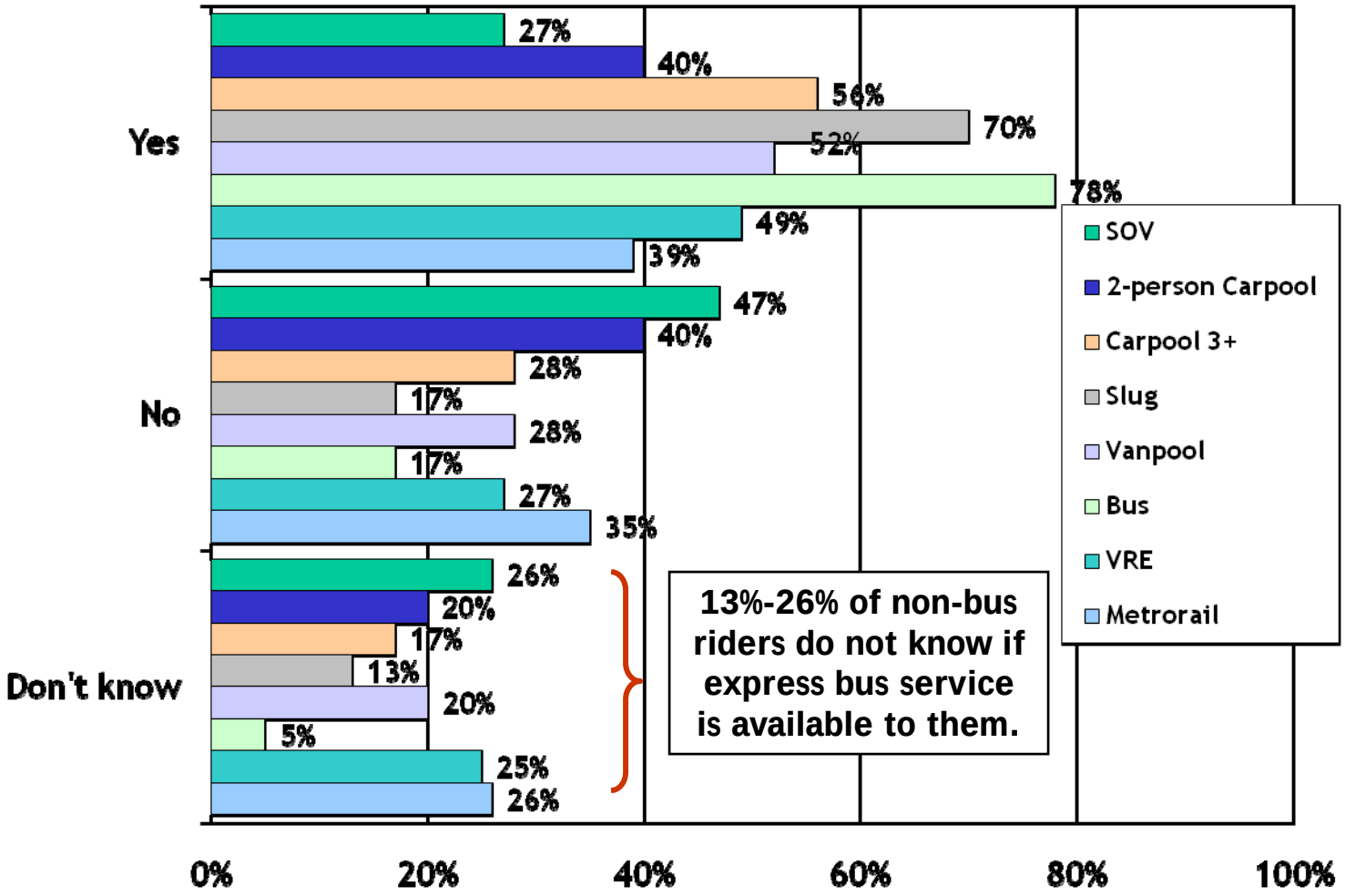
*Many of the following slides report stated likelihood of usage of specific transit and TDM enhancements and alternatives. Research indicates that respondents often overstate their likelihood of usage. A demand discount factor has been developed that allows researchers to more accurately project responses.*

*This demand discount factor has been applied on the following measures when a 5-point "likelihood" scale is used, as appropriate.*

# Sluggers and Bus Riders Are Most Likely to Have Express Bus Service Available

**Question asked of all respondents.**

Q46. Is there express bus service reasonably available for the area where you commute? An express bus service is a motorcoach or bus, generally traveling longer distance with limited stops, taking commuters to their work areas.





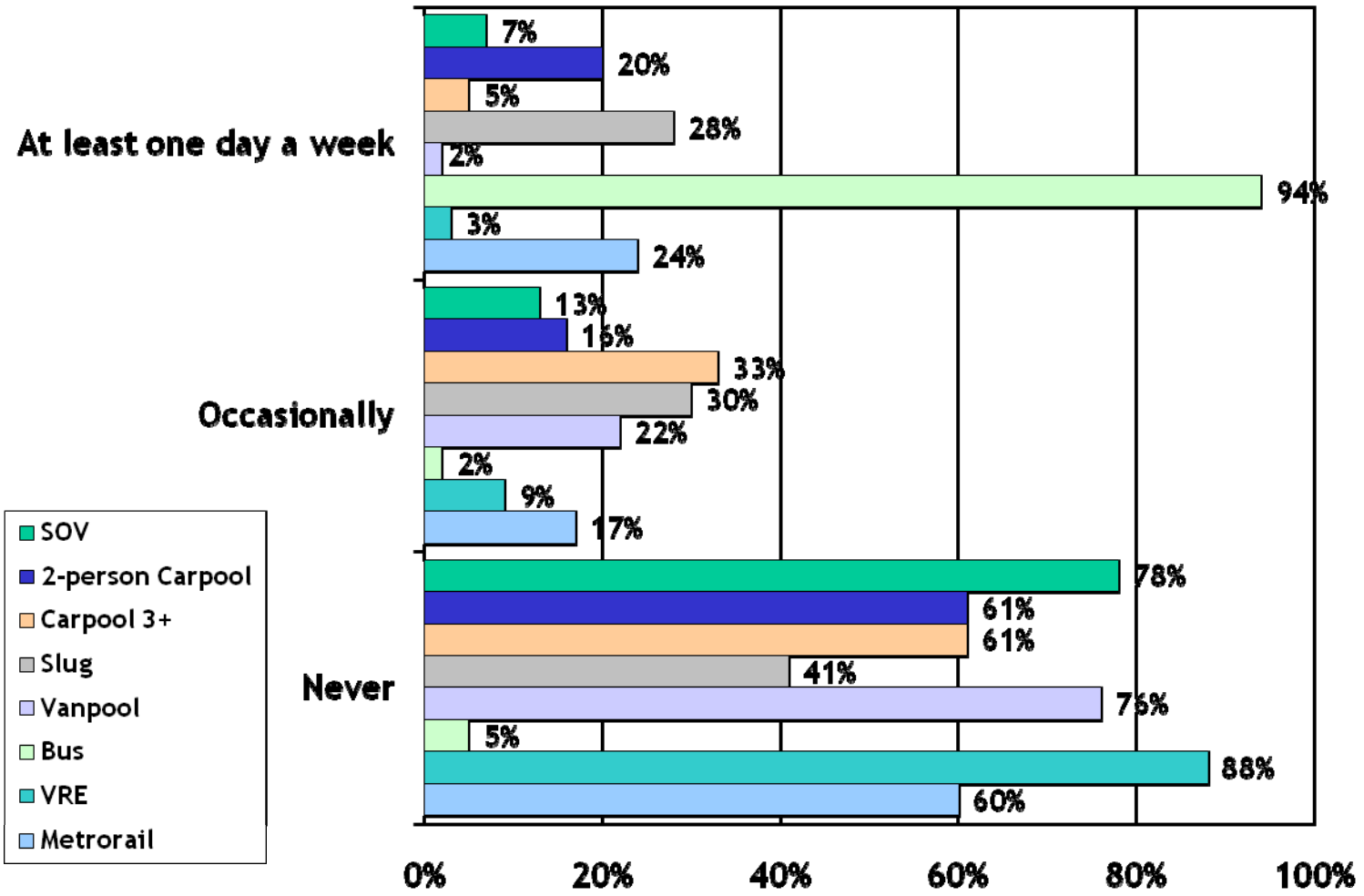

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SOV, n=223
2-person carpool, n=51
Carpool 3+, n=128
Slug, n=424
Vanpool, n=142
Bus, n=306
VRE, n=245
Metrorail, n=72

# Among Non-Bus Riders, Sluggers Are Most Likely to Ride an Express Bus – But, Not All Bus Riders Say that They Ride an Express Bus; VRE Riders Tend Not to Use Express Bus Service Even When Available

**Question asked of all respondents who said express bus service is available.**

Q47. How often do you use that express bus service?



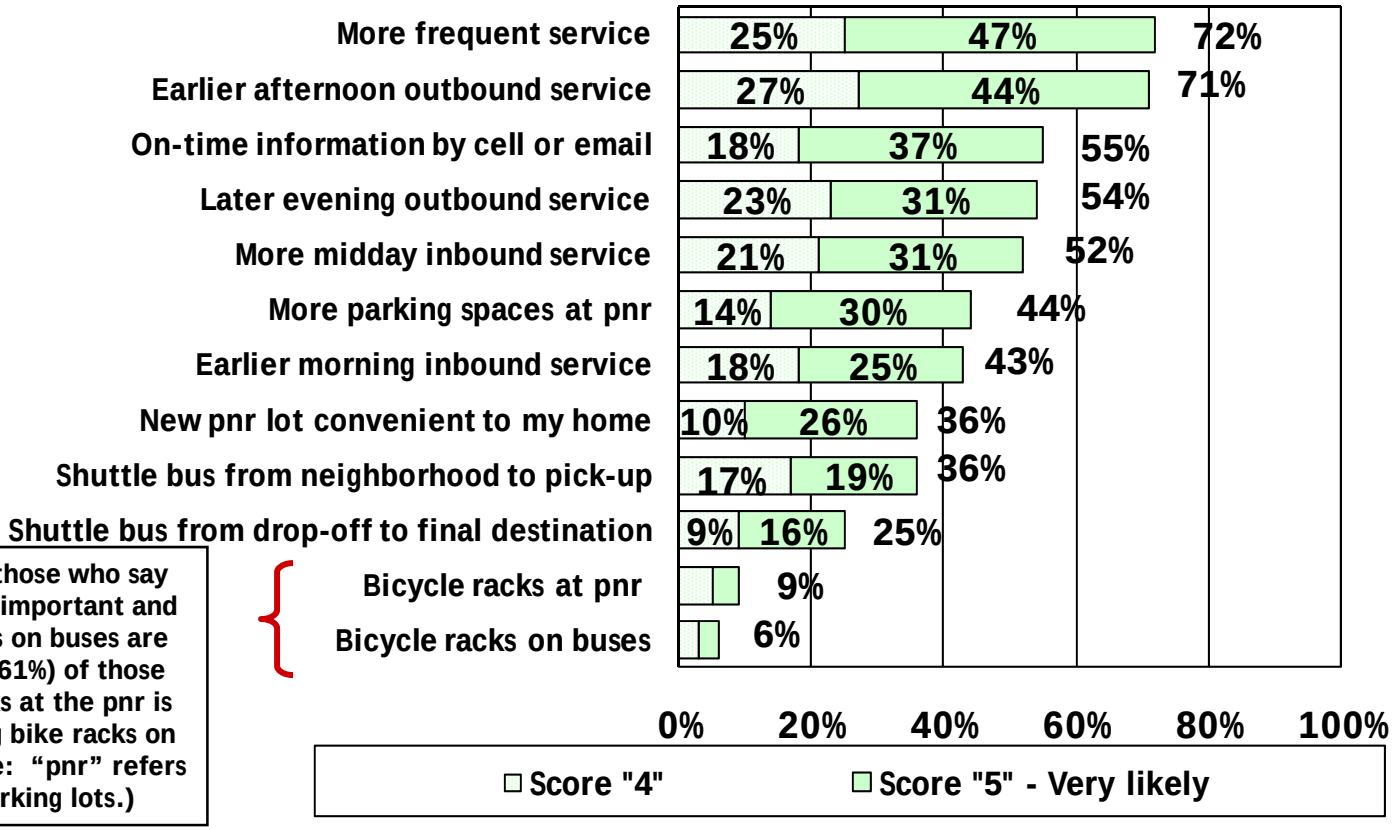



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n=154, n varies slightly for each attribute (each respondent rated half of list)

**Proportions represent responses of those who use express bus as primary mode.**

# More Frequent Service and Earlier Afternoon Outbound Service Increase the Appeal of Express Bus Service among Current Riders




There is overlap among those who say bike racks at the pnr are important and those who say bike racks on buses are important. Two-thirds (61%) of those who say having bike racks at the pnr is important also say having bike racks on buses is important. (Note: "pnr" refers to "park-and-ride" parking lots.)

Q47A. Next is a list of potential improvements to that express bus service. Please indicate how important each improvement would be to you in helping you choose to continue riding express bus service or to increase your usage.

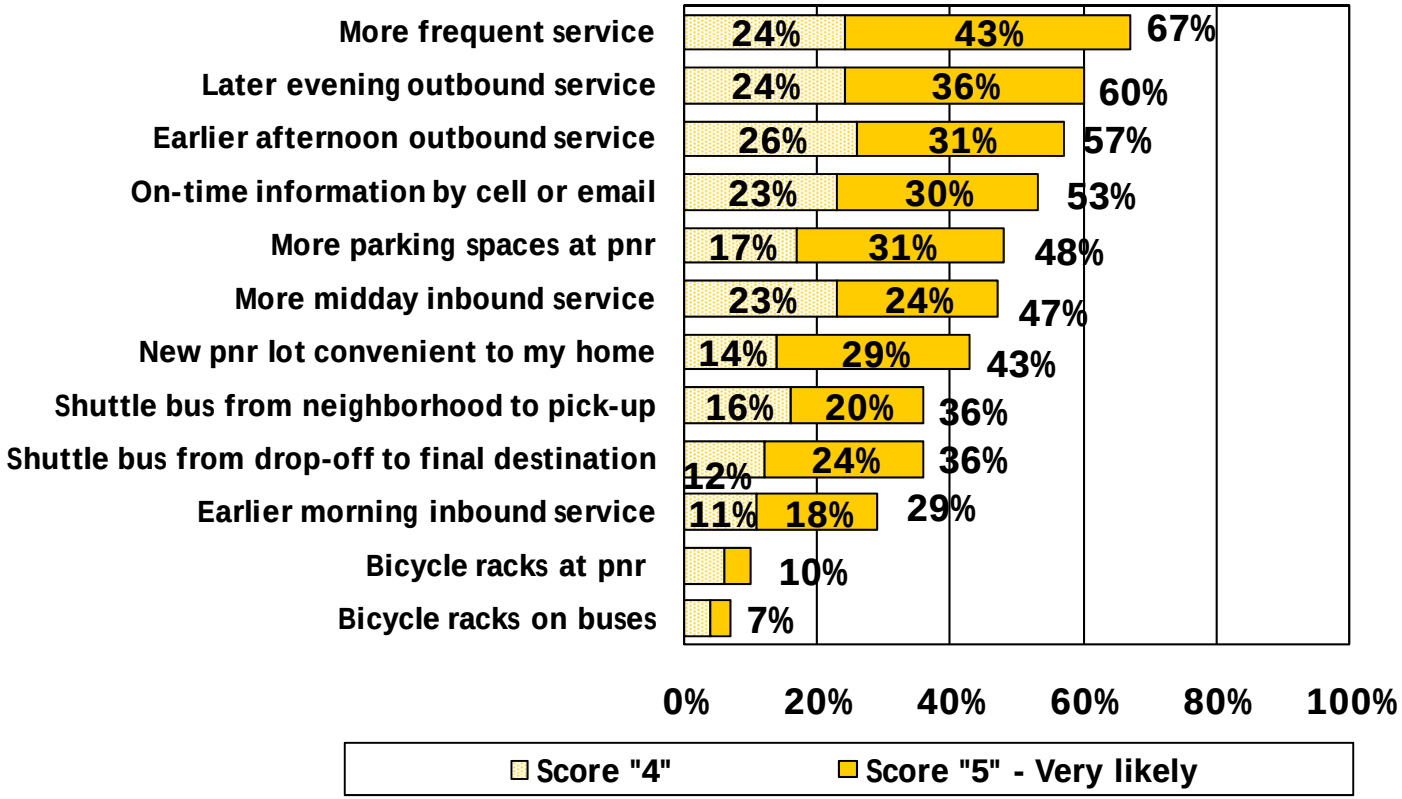


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n=129, n varies slightly for each attribute (each respondent rated half of list)

**Proportions represent responses of those who use express bus but not as primary mode.**

# Of the Potential Improvements Tested, More Frequent Service Would Impact the Greatest Proportion of Those Who Ride the Express Bus Although It Is Not their Primary Mode




Q47A. Next is a list of potential improvements to that express bus service. Please indicate how important each improvement would be to you in helping you choose to continue riding express bus service or to increase your usage.



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# Meeting the Needs of Current Riders Can Help Retain Riders and Potentially Increase Frequency of Riding

**Lists indicate strongest opportunities for each company.**

Q47A. Next is a list of potential improvements to that express bus service. Please indicate how important each improvement would be to you in helping you choose to continue riding express bus service or to increase your usage.

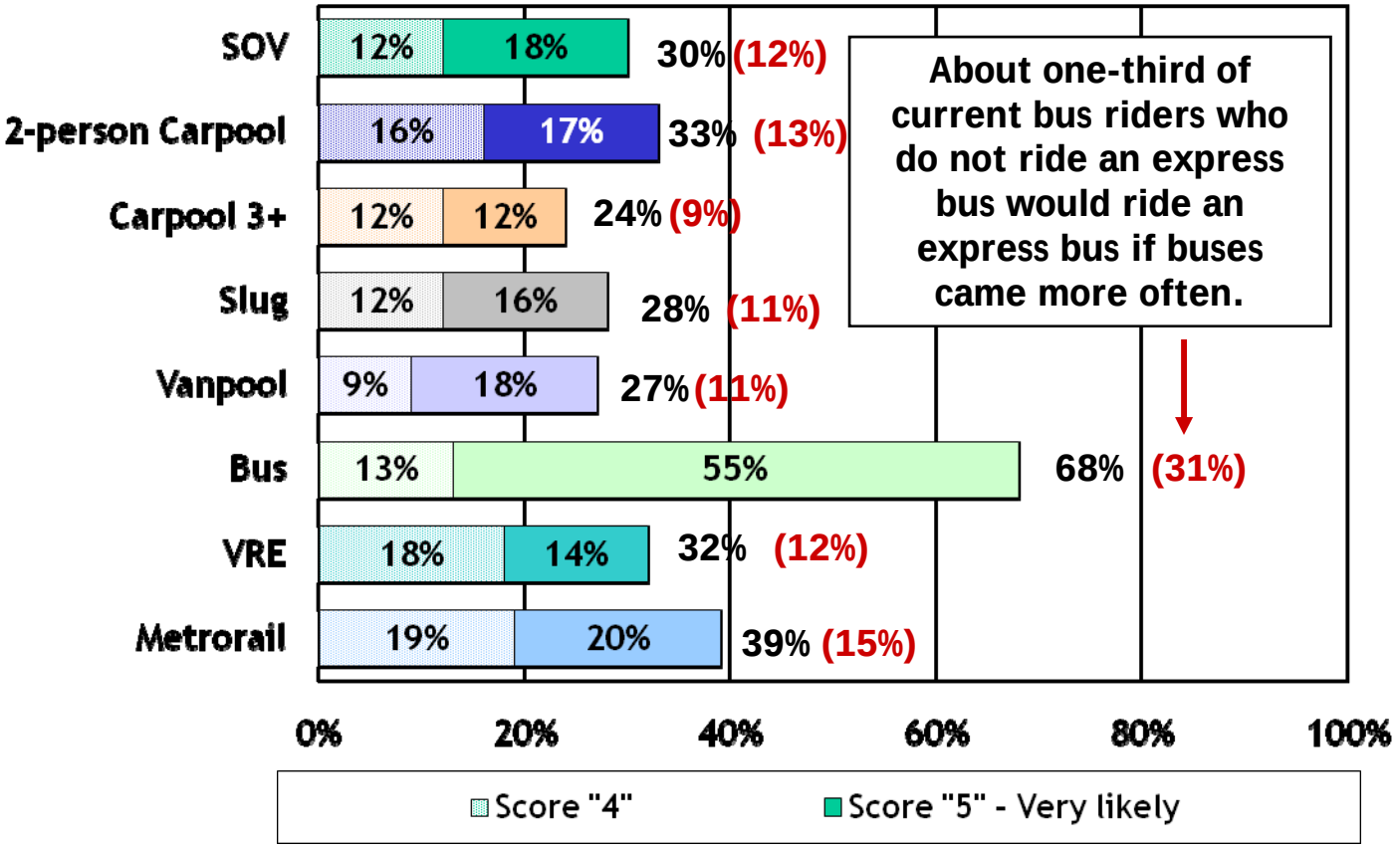
- PRTC
  - Earlier afternoon outbound service
  - Later evening outbound service
  - More parking at existing park-and-ride
  - More midday inbound service
  - New park-and-ride more convenient to home
  - Shuttle bus from neighborhood to pickup point
- Metrobus/WMATA
  - On-time information by cell or email
  - Earlier afternoon outbound service
  - Later evening outbound service
  - More midday inbound service
- Martz (small base size)
  - Earlier afternoon outbound service

SOV, n=772
2-person carpool, n=108
Carpool 3+, n=181
Slug, n=355
Vanpool, n=234
Bus, n=100
VRE, n=472
Metrorail, n=156

# About One-Fourth to One-Third of Non-Bus Riders Say They Would Ride an Express Bus 1-2 Days a Week if Buses Came More Often – The Discount Demand Factor Brings This Down to about 1 out of 10

**Values in red font indicate total scores after discount demand factor has been applied.**

**Question asked of all who do not use express bus service.**




Q49. If the schedule were revised so that express buses came more often, how likely would you be to ride an express bus at least 1-2 days a week?

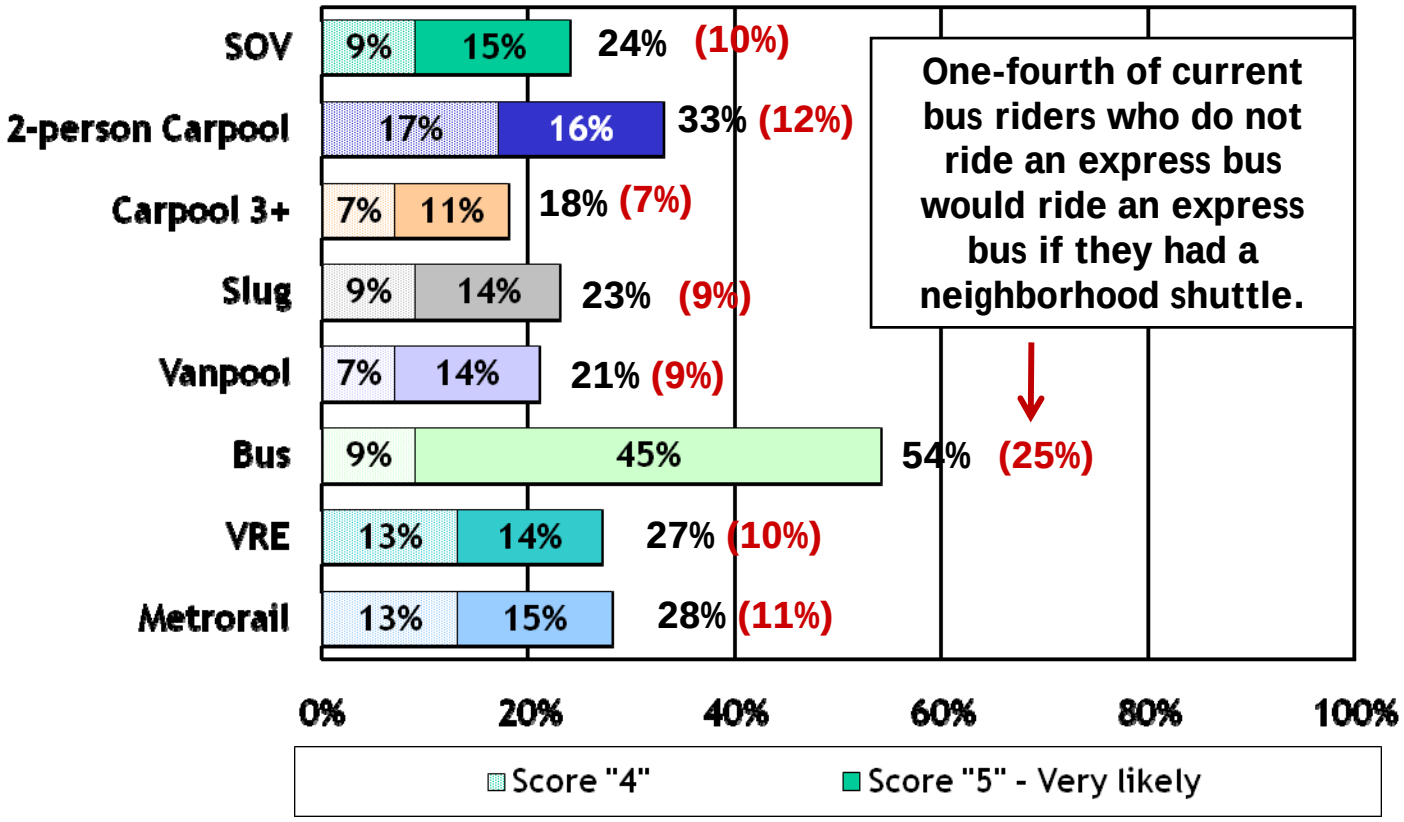


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SOV, n=772
2-person carpool, n=108
Carpool 3+, n=181
Slug, n=355
Vanpool, n=234
Bus, n=100
VRE, n=472
Metrorail, n=156

# About One-Fourth of Non-Bus Riders Say They Would Ride an Express Bus 1-2 Days a Week if They Had a Shuttle in Their Neighborhood – With The Demand Discount Factor, Likelihood Is about 10%

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not use express bus service.**

Q50. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to an express bus stop. How likely would you be to ride an express bus at least 1-2 days a week if such a feeder bus service operated?



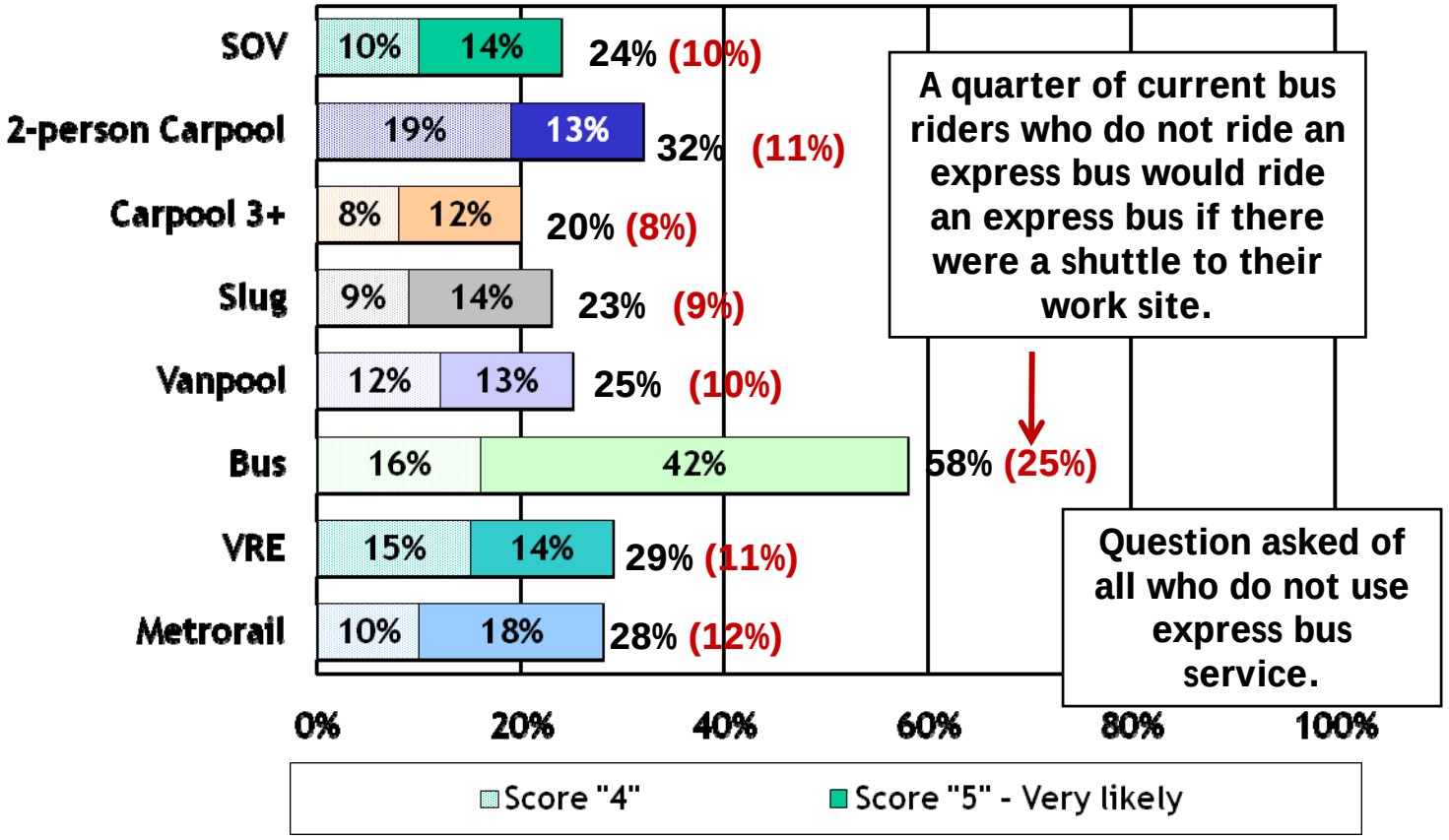
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SOV, n=772
2-person carpool, n=108
Carpool 3+, n=181
Slug, n=355
Vanpool, n=234
Bus, n=100
VRE, n=472
Metrorail, n=156

# About One-Fourth of Non-Bus Riders Also Say They Would Ride an Express Bus 1-2 Days a Week if They Had a Shuttle from Their Drop-off Point to Their Commute Destination

**Values in red font indicate total scores after discount demand factor has been applied.**

**Note: The question did not specify service schedule for this shuttle. The schedule was described as "operate frequently in the morning and afternoon peak hours."**




**A quarter of current bus riders who do not ride an express bus would ride an express bus if there were a shuttle to their work site.**

**Question asked of all who do not use express bus service.**

Q51. Suppose that a shuttle bus service could operate frequently in the morning and afternoon peak hours between the express bus drop-off point and your commute destination. How likely would you be to ride an express bus at least 1-2 days a week if such a shuttle bus service operated?



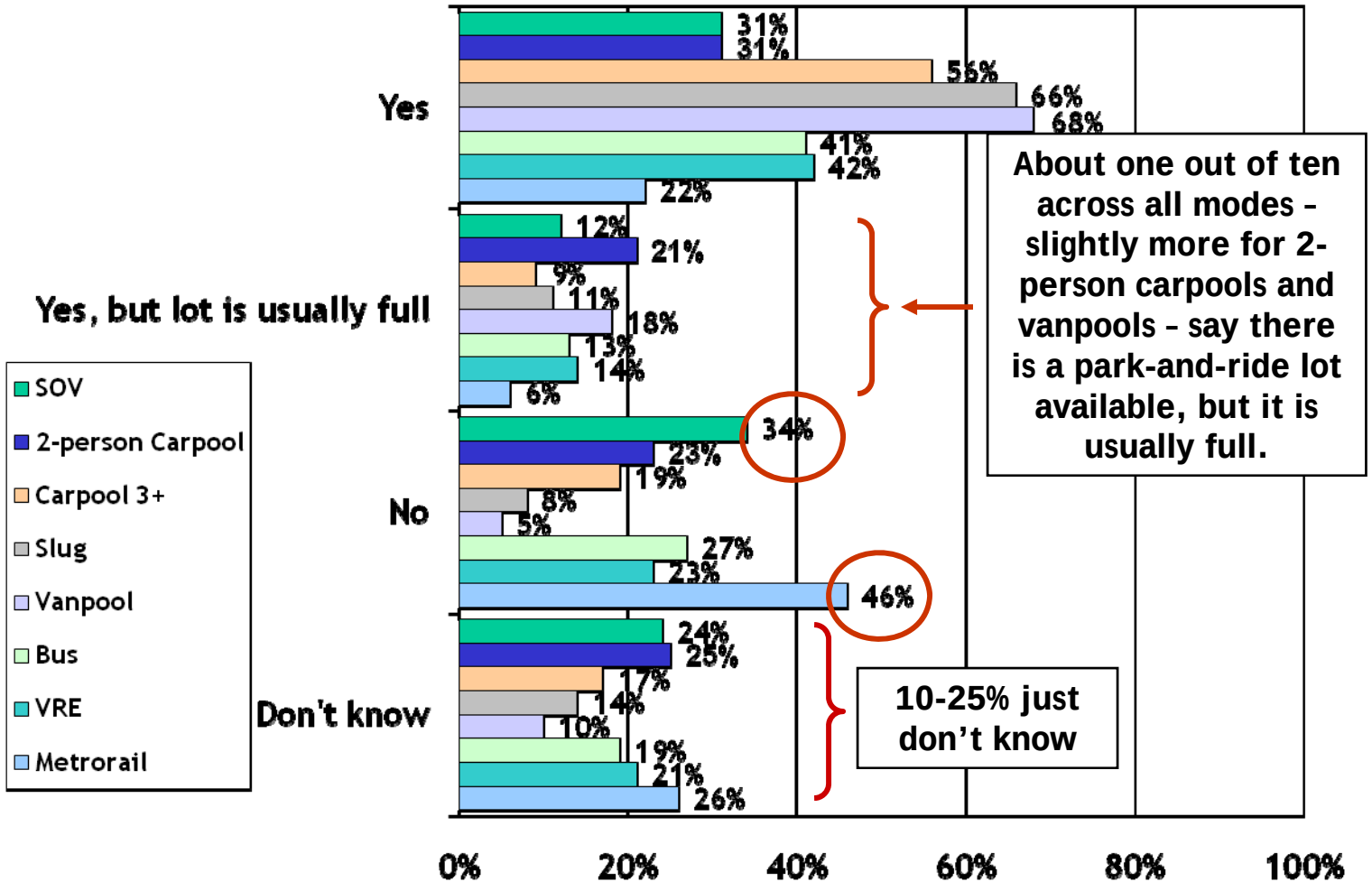
DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=772
2-person carpool, n=108
Carpool 3+, n=181
Slug, n=355
Vanpool, n=234
Bus, n=100
VRE, n=472
Metrorail, n=156

# One-third of SOVers and Nearly Half of Metrorail Riders Say There Is No Park-and-Ride Lot Located Along Their Commute

**Question asked of all respondents.**

Q52. Is there a park-and-ride lot located along your commute where you could catch an express bus?



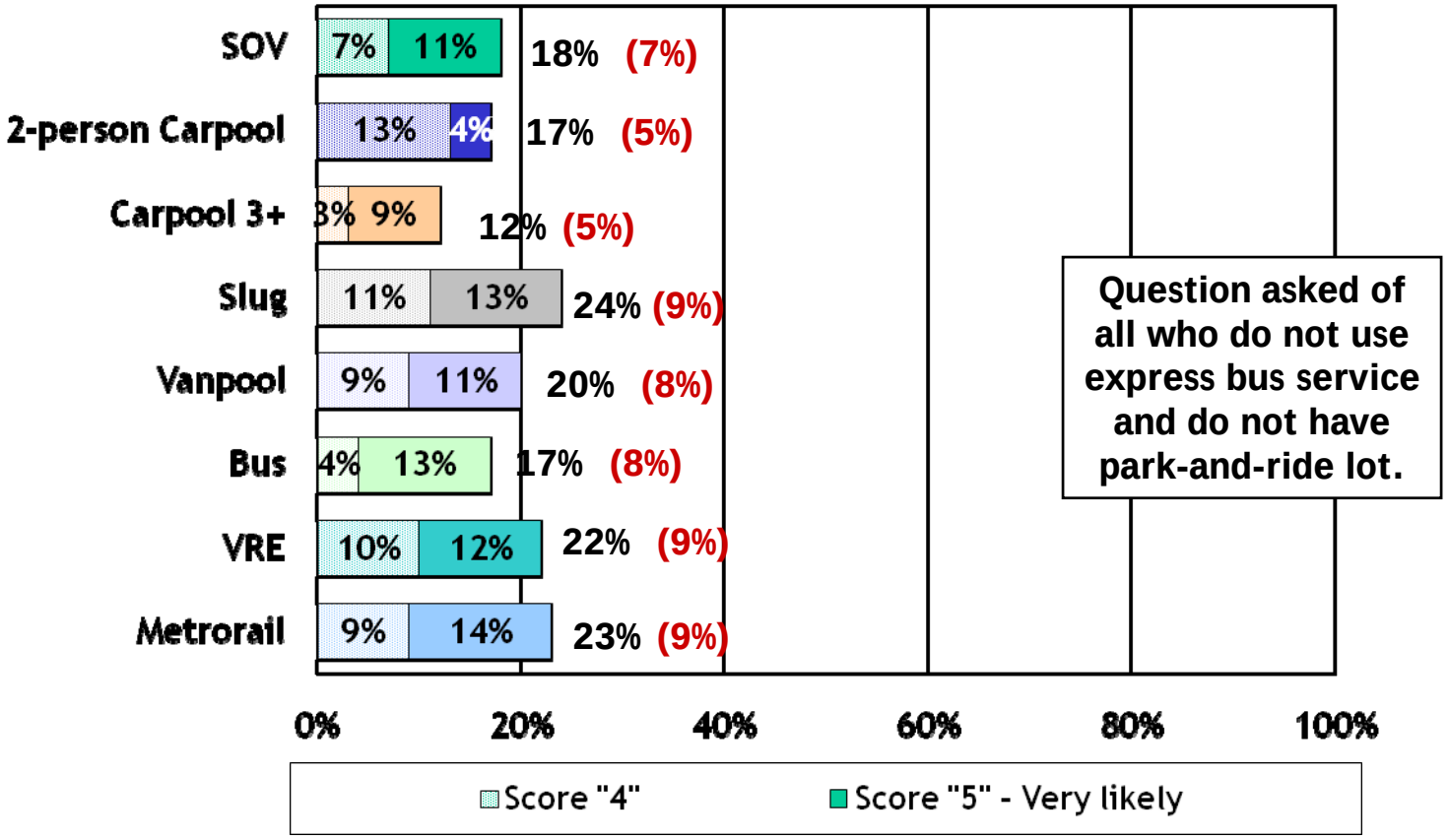



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SOV, n=444
2-person carpool, n=52
Carpool 3+, n=64
Slug, n=79
Vanpool, n=35
Bus, n=46
VRE, n=208
Metrorail, n=112

# A Park-and-Ride Lot Could Attract about 5-9% of Those Who Do Not Currently Have A Park-and-Ride Lot Available

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not use express bus service and do not have park-and-ride lot.**

Q53. If there were a new park-and-ride lot located along your commute, how likely would you be to use it at least 1-2 days a week in order to take an express bus?



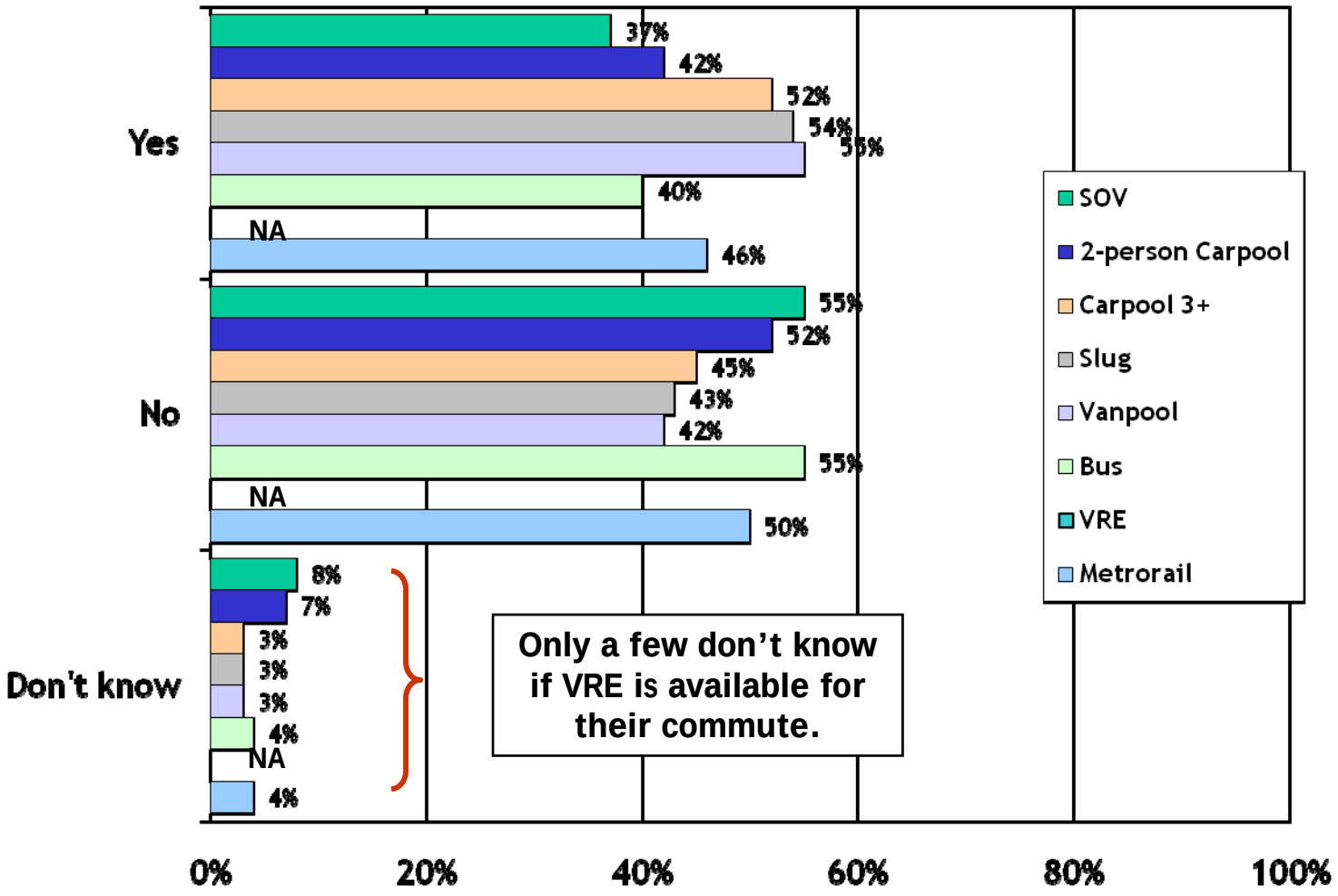
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SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# One-Third to Slightly More than One-Half of Those Who Do Not Currently Ride VRE Say That VRE Is Conveniently Available for Their Commute

**Question asked of all respondents who do not ride VRE.**

Q55-B. Is Virginia Railway Express (VRE) conveniently available for at least a portion of your commute?



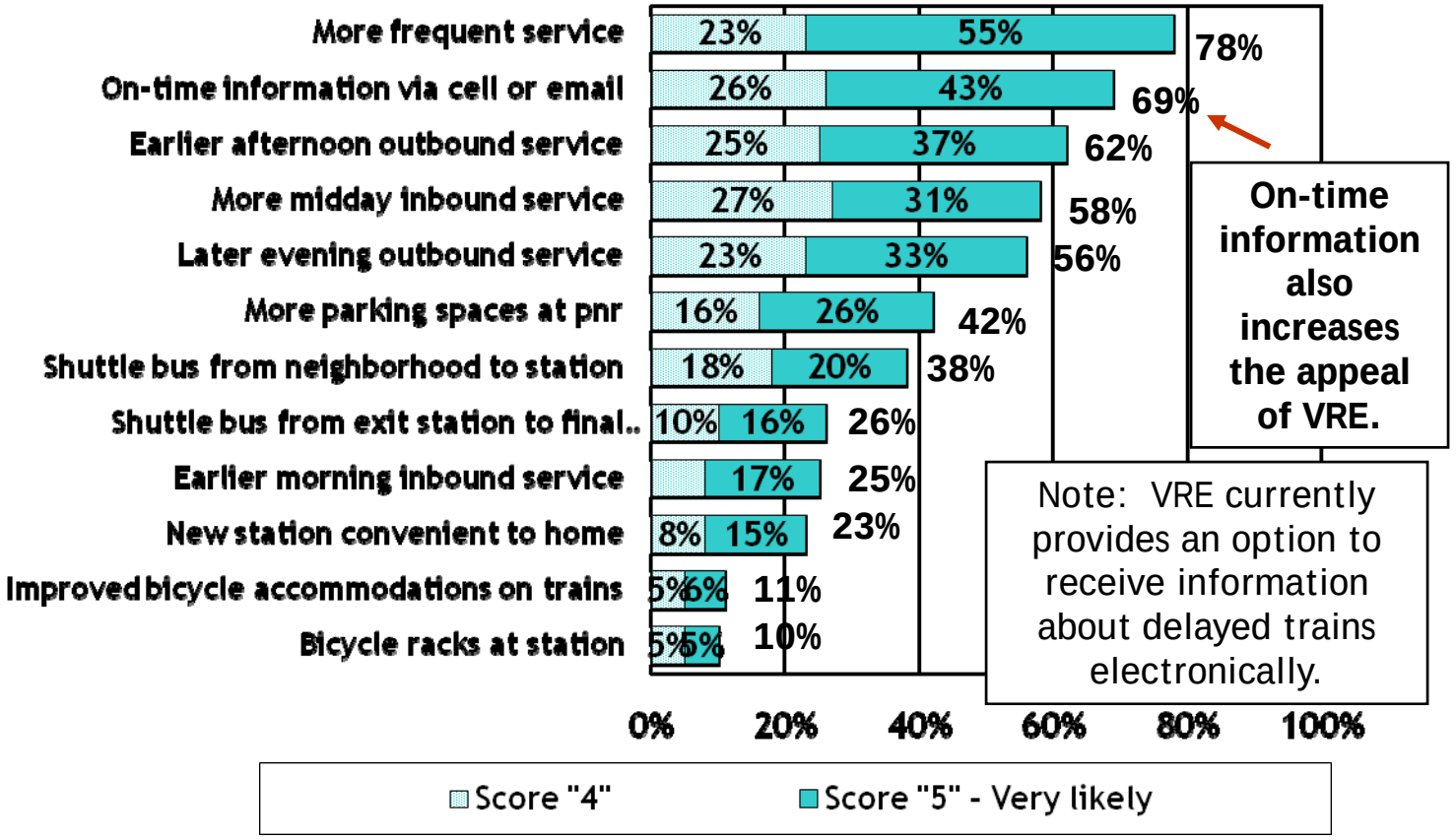



DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

n=227, n varies slightly for each attribute (each respondent rated half of list)

**Proportions shown represent those for whom VRE is primary mode.**

# More Frequent Service Increases the Appeal of VRE Among Commuters for Whom VRE Is the Primary Mode




Q55-A. Earlier you indicated that you use the VRE service. Following is a list of potential improvements to that service. Please indicate how important each improvement would be to you in helping you choose to continue riding VRE or to increase your usage.

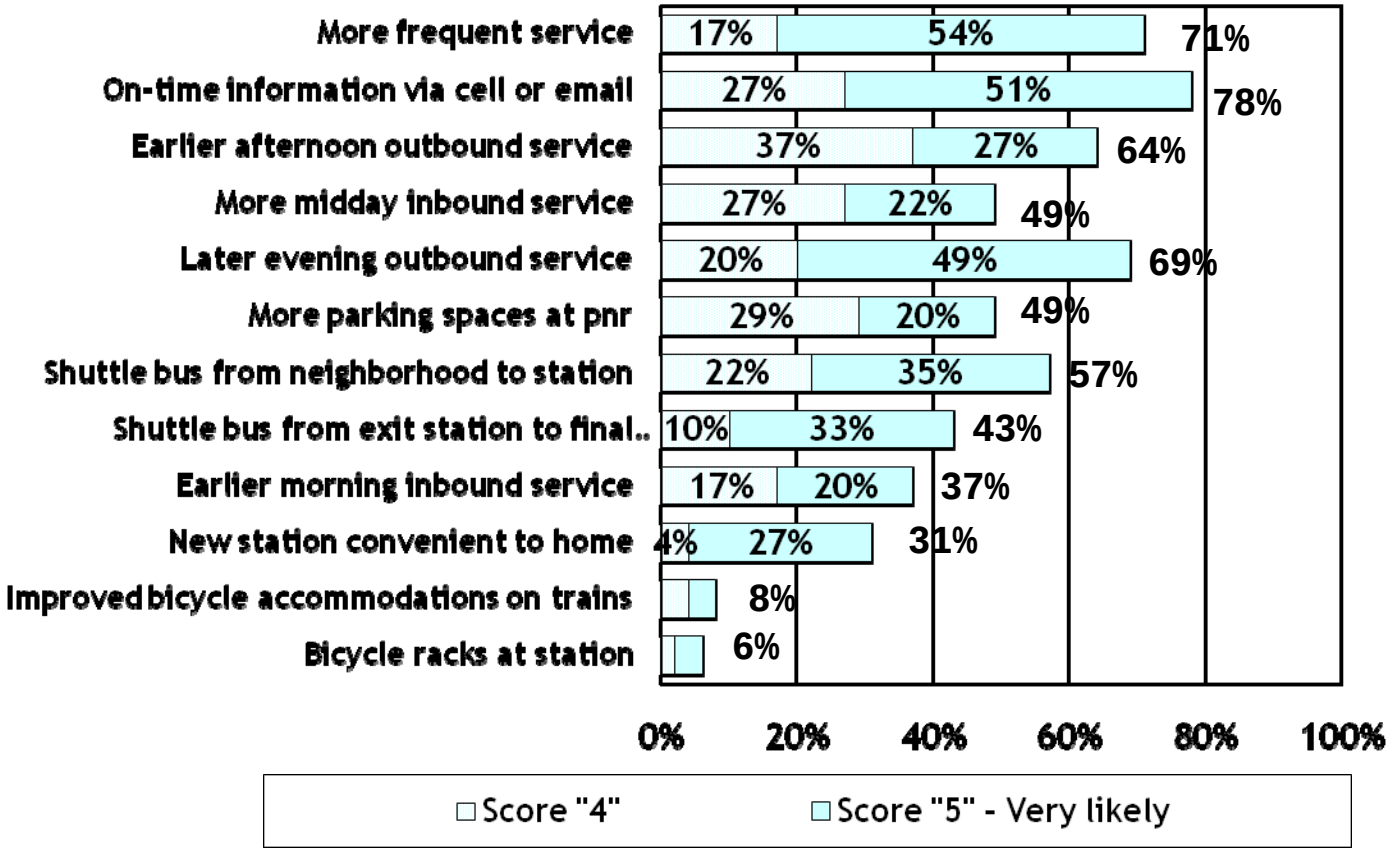


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

n=40, n varies slightly for each attribute (each respondent rated half of list)

**Proportions shown represent those who use VRE, but it is not their primary mode.**

# On-time Information and More Frequent Service Also Increases the Appeal of VRE Among Commuters Who Ride VRE But It Is Not Their Primary Mode




Q55-A. Earlier you indicated that you use the VRE service. Following is a list of potential improvements to that service. Please indicate how important each improvement would be to you in helping you choose to continue riding VRE or to increase your usage.



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n=86

# About One-Half of those Living South of Fredericksburg Say They Would Be Likely to Ride VRE if a VRE Station Were Constructed South of Fredericksburg

*Question: If a VRE station were constructed south of Fredericksburg, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?*

| | |
|---|---|
| Score "5" – Very likely | 42% |
| Score "4" | 5% |
| Score "3" | 9% |
| Score "2" | 7% |
| Score "1" – Not at all likely | 31% |
| Don't know | 6% |

**47% say they would likely ride VRE if a station were constructed south of Fredericksburg**

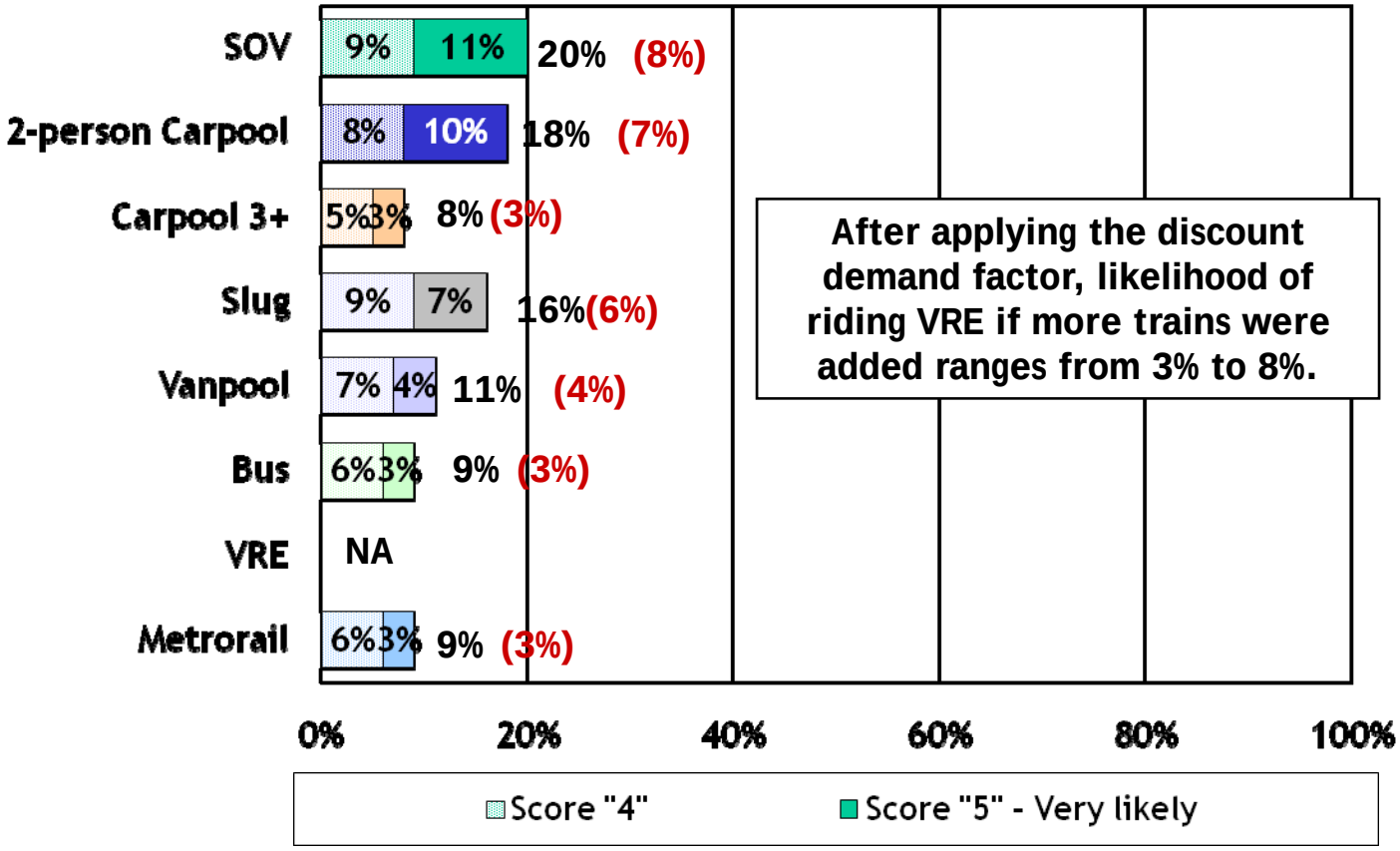
Note: Question asked of those who live in zip codes south of Fredericksburg.

Q56. If a VRE station were constructed south of Fredericksburg, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?

SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# About 8% of SOVers with VRE Available Would Be Likely to Use VRE at Least 1-2 Days a Week if Trains Came More Often

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not ride VRE and have VRE service available.**

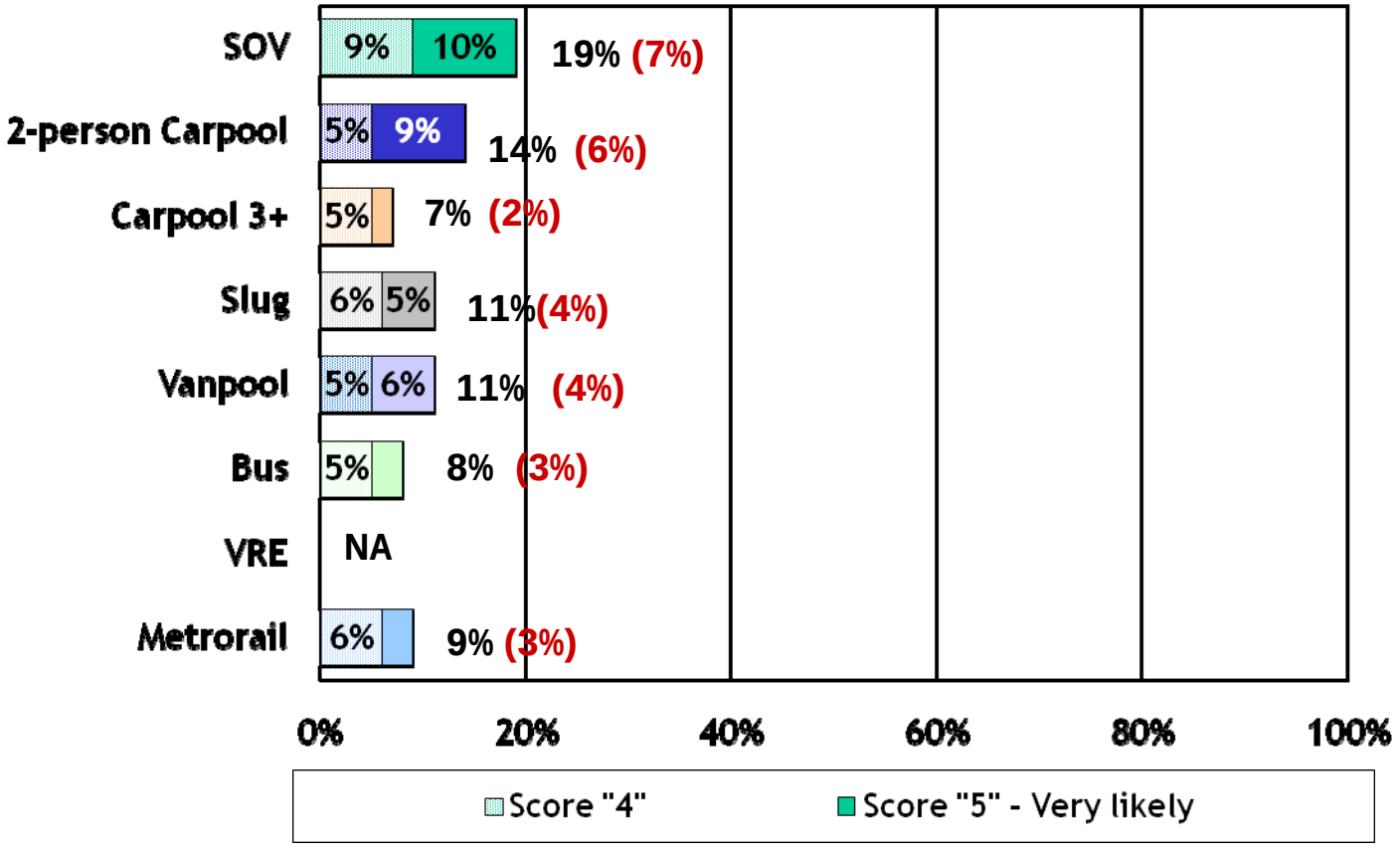
Q57. If additional VRE trains were added so that they came more often, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?



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SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# Likelihood of Riding VRE if There Were More Seats Ranges from 2% to 7%




**Values in red font indicate total scores after discount demand factor has been applied.**

**Question asked of all who do not ride VRE and have VRE service available.**

Q58. If VRE trains had more seats available, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?

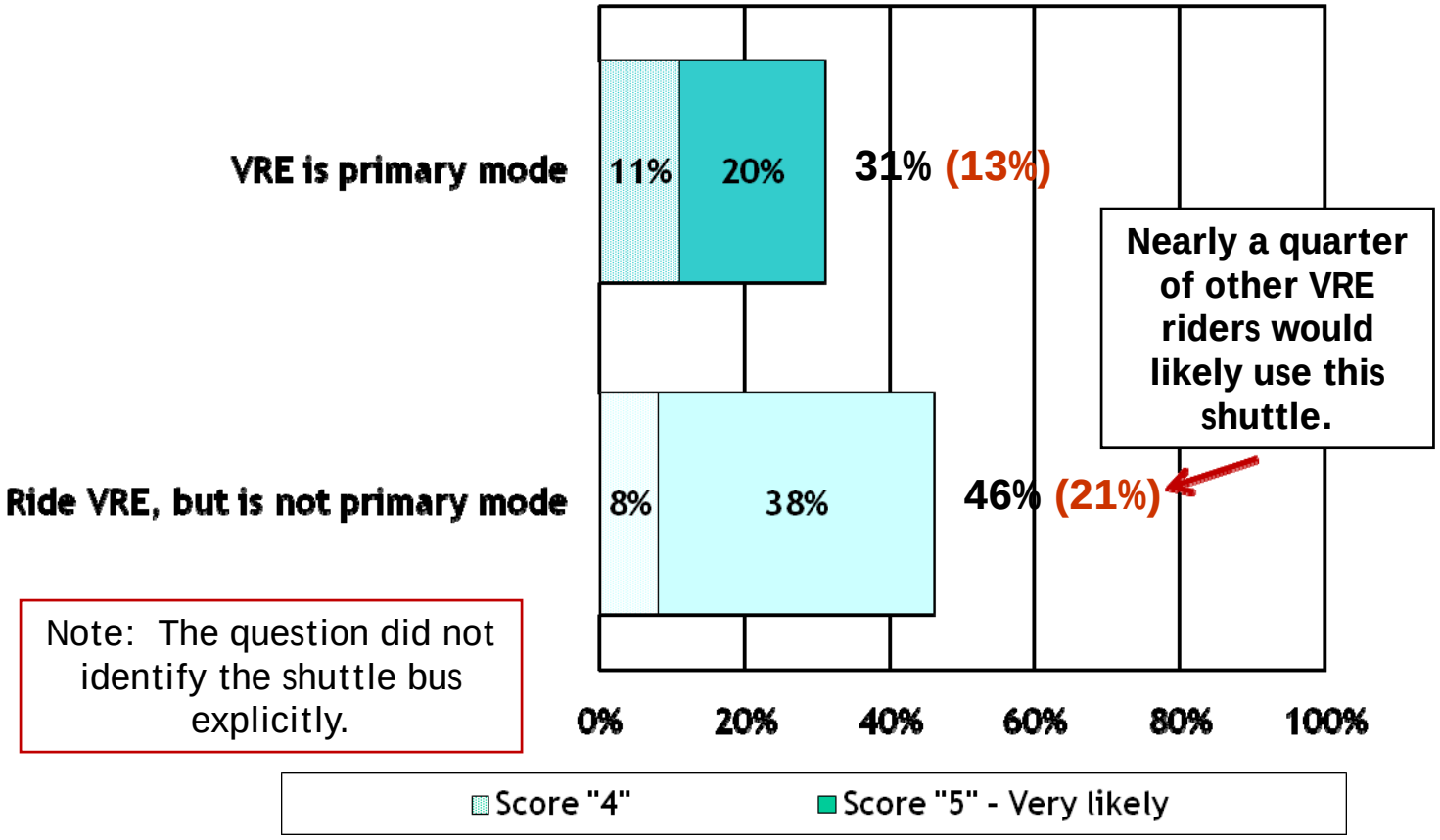


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Virginia Department of Rail and Public Transportation
The Smartest Distance Between Two Points

VRE is primary mode, n=501
Ride VRE, but is not primary mode, n=92

# Nearly One-Third Who Use VRE as Their Primary Commute Mode Would Take a Shuttle That Runs from the VRE Station to Their Destination

**Values in red font indicate total scores after discount demand factor has been applied.**




Note: The question did not identify the shuttle bus explicitly.

**Question asked of those who ride VRE – as primary mode and non-primary mode.**

Q59. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to take this shuttle bus?



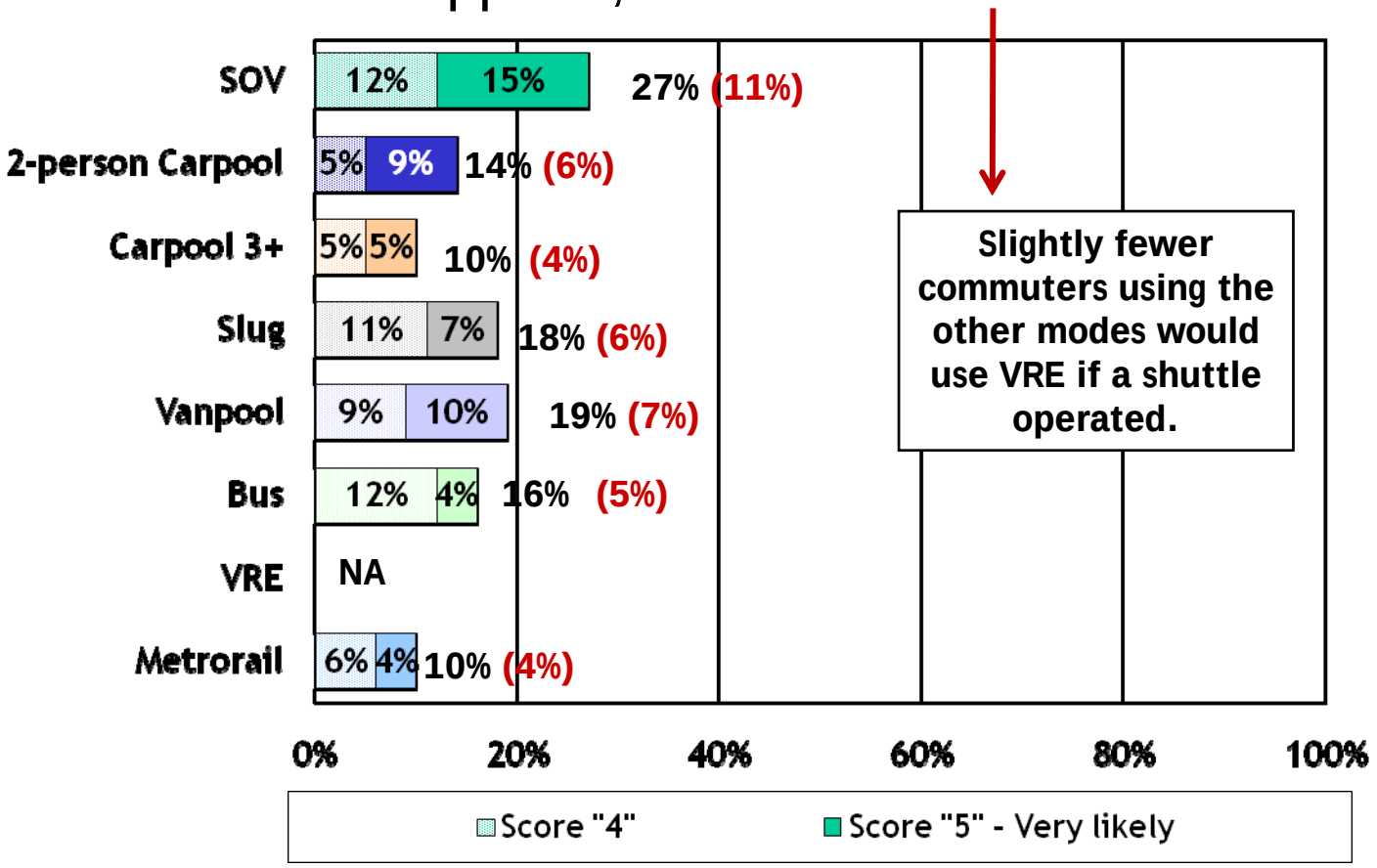
DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# One-Fourth of SOVers Say They Would Ride VRE If a Shuttle Bus Operated to Their Commute Destination – With the Demand Discount Factor Applied, about 1 out of 10

**Values in red font indicate total scores after discount demand factor has been applied.**

**Question asked of all who do not ride VRE and have VRE service available.**




Q60. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to ride VRE if this shuttle bus service were offered?

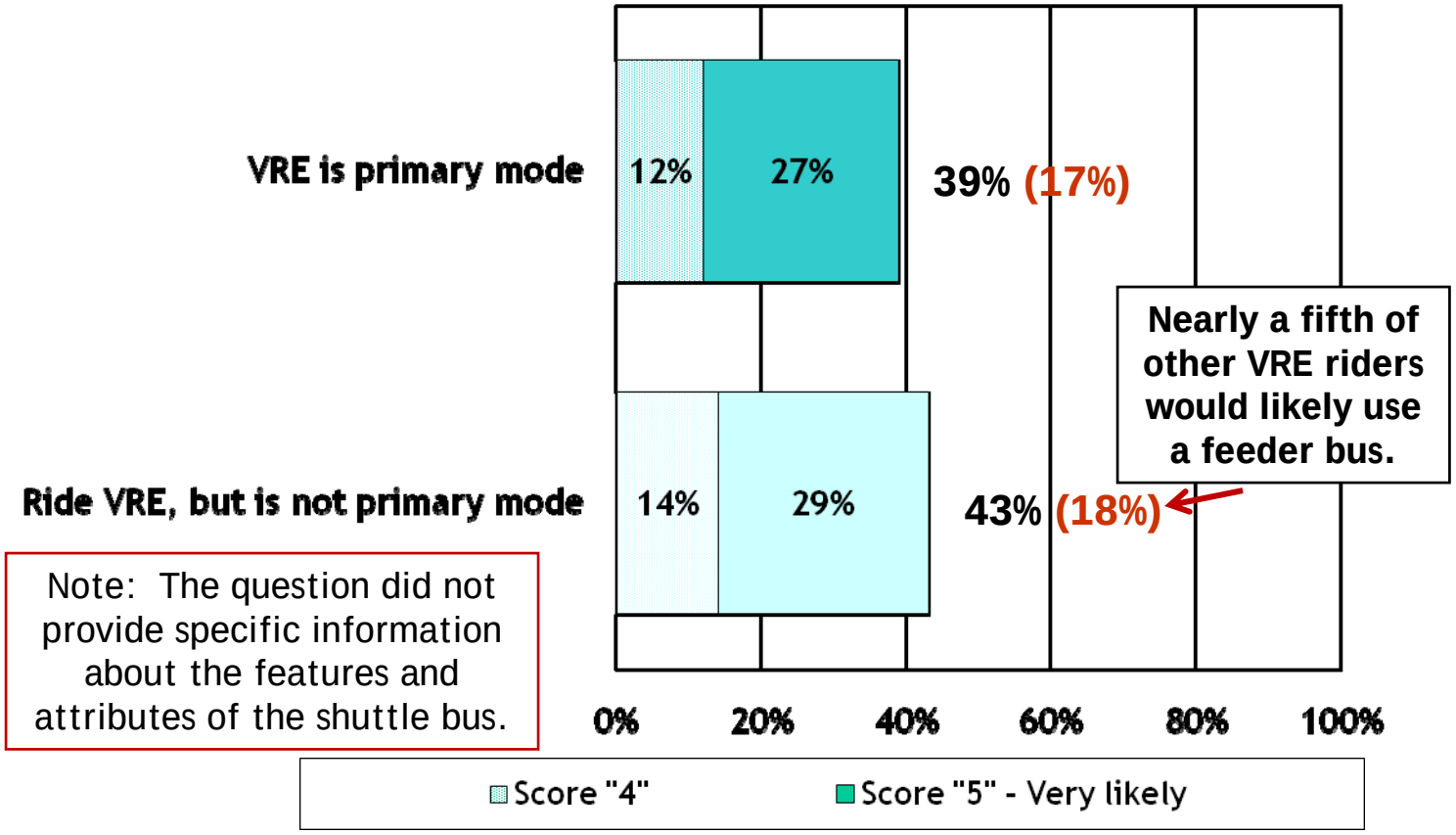


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

VRE is primary mode, n=501
Ride VRE, but is not primary mode, n=92

**Question asked of those who ride VRE – as primary mode and non-primary mode.**

# 17% Who Use VRE as Their Primary Commute Mode Would Likely Use a Feeder Bus from Their Neighborhood




Note: The question did not provide specific information about the features and attributes of the shuttle bus.

Q61. Suppose a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the VRE train station. How likely would you be to use this feeder bus?



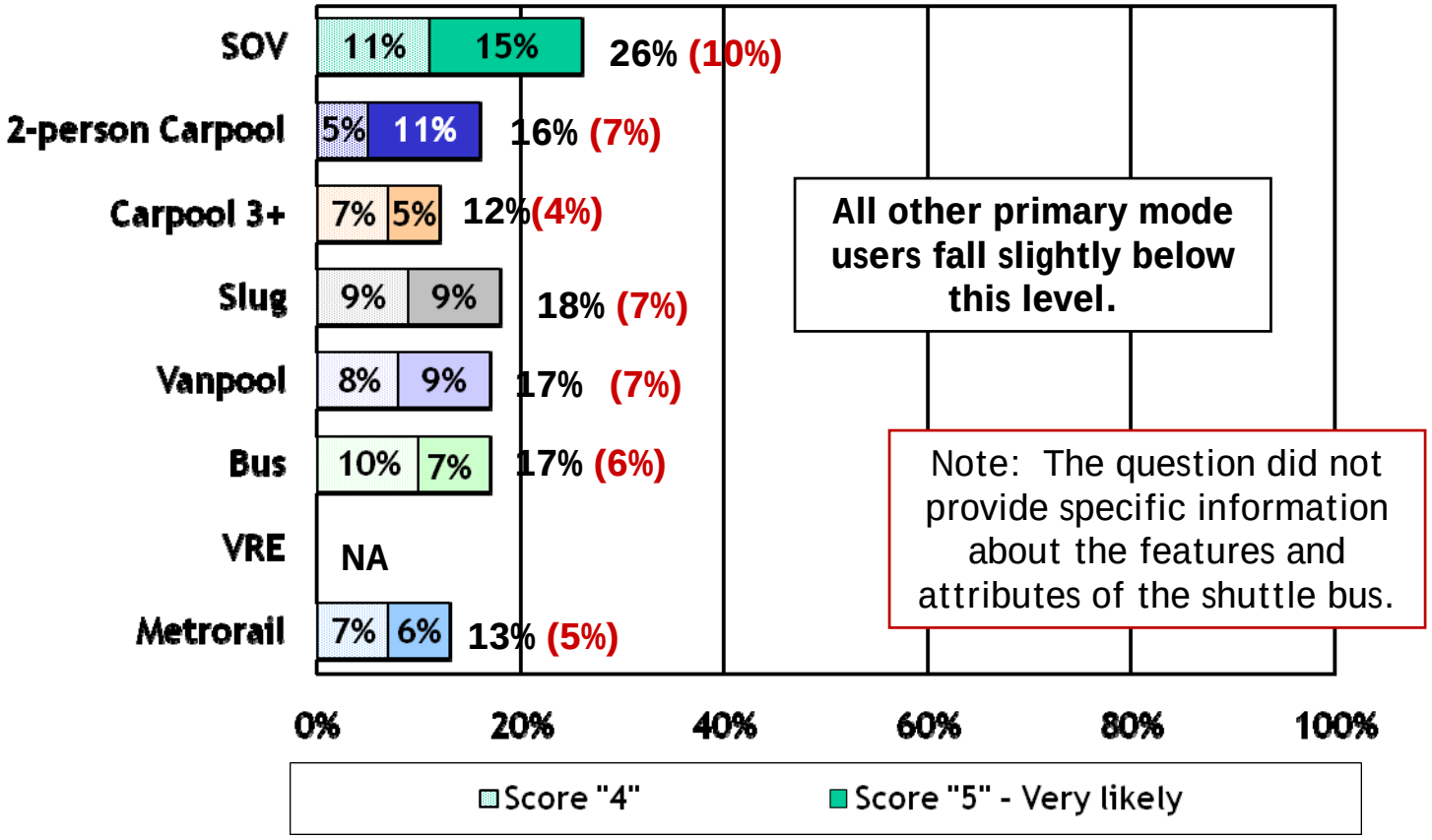
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Virginia Department of Rail and Public Transportation
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SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# One-Fourth of SOVers Also Say They Would Ride VRE If a Feeder Bus Operated in Their Neighborhood – Which Factors to about 10%

**Values in red font indicate total scores after discount demand factor has been applied.**

**Question asked of all who do not ride VRE and have VRE service available.**




Q62. Suppose a shuttle feeder bus could operate frequently in your neighborhood that would circulate and connect to the VRE train station. How likely would you be to use this feeder bus and take VRE at least 1-2 days a week?

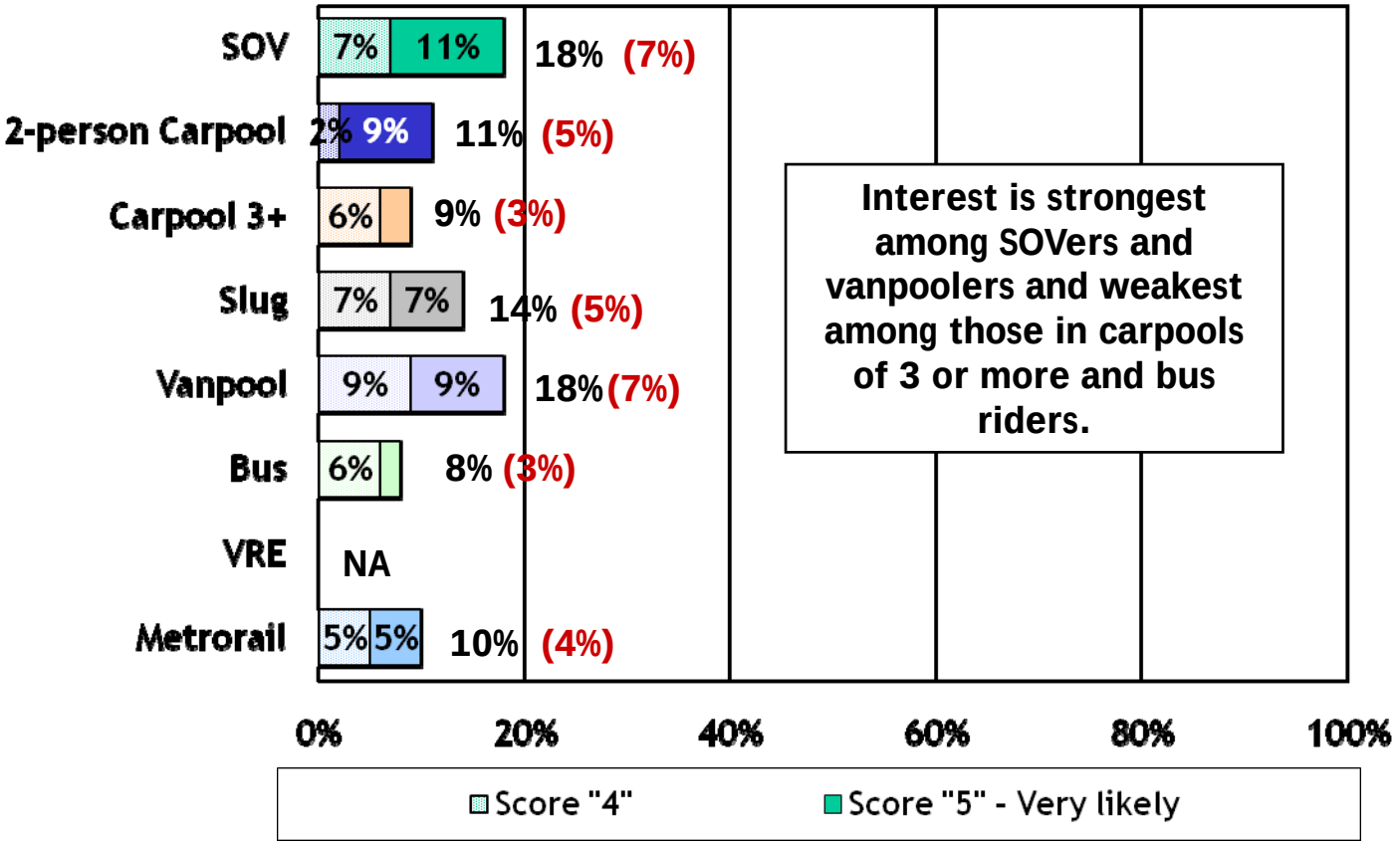


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=796
2-person carpool, n=120
Carpool 3+, n=222
Slug, n=580
Vanpool, n=265
Bus, n=382
Metrorail, n=185

# More Parking Increases the Stated Appeal of VRE among Slightly Less than One-Fifth of Commuters – Less than 10% when the Discount Factor Is Applied

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not ride VRE and have VRE service available.**

Q63. If more parking were available at VRE train stations, how likely would you be to take VRE at least 1-2 days a week?



DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

n=2,695

# Stated Likelihood of VRE Use if Parking Were Available Is Concentrated in Stafford, Woodbridge, Fredericksburg, Stafford and Spotsylvania

**Values represent the proportion each area of residence makes up of the total who said "4" or "5" - they would be likely to ride VRE if more parking were available at VRE train stations.**

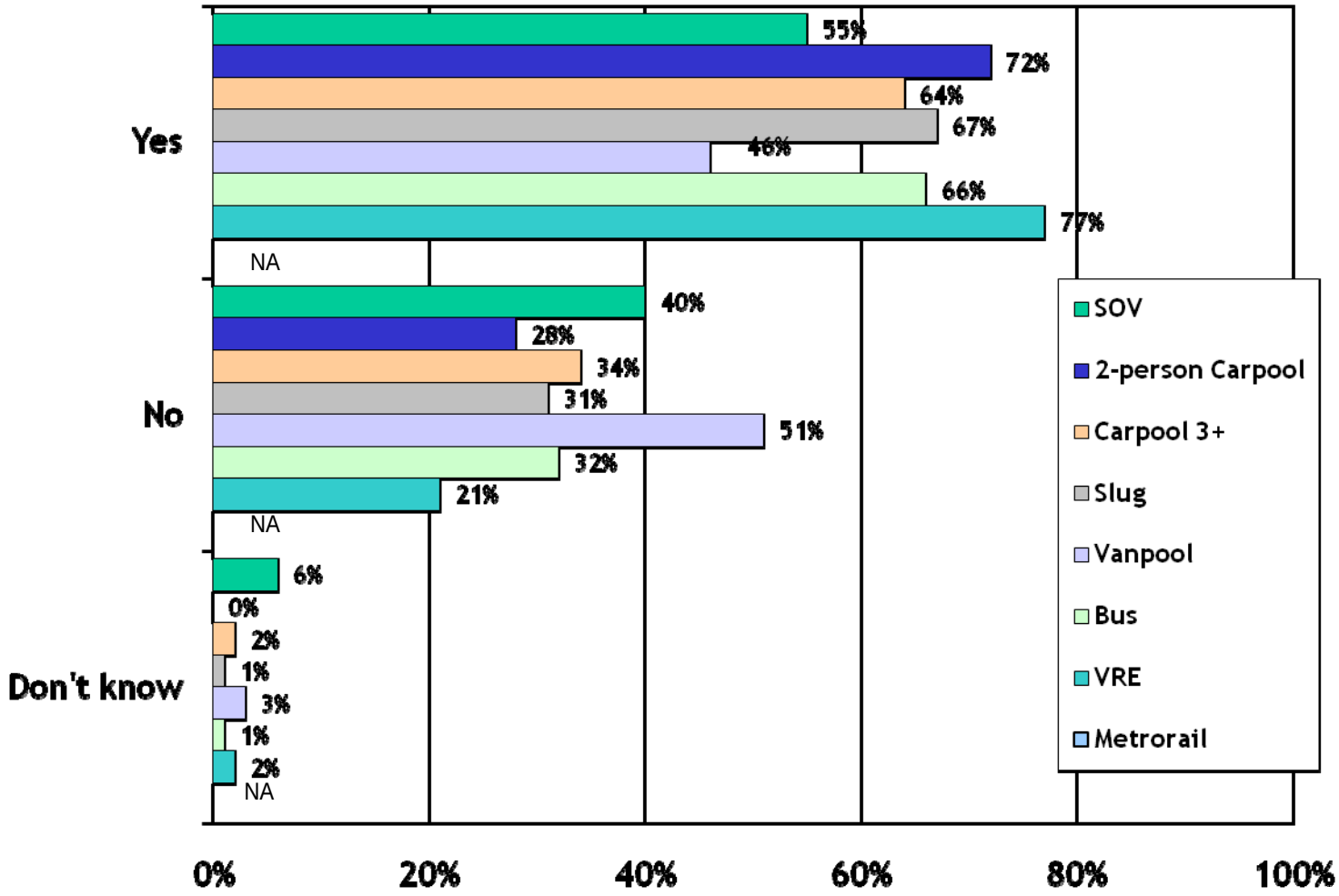
| | |
|---|---|
| Woodbridge [zips: 22191, 22192, 22193(Dale City)] | 16% |
| Fredericksbsurg (zips: 22406, 22407, 22408) | 15% |
| Stafford (zip: 22554) | 11% |
| Spotsylvania (zips: 22407, 22408, 22553) | 10% |
| Springfield (zips: 22015 22152) | 9% |
| Other Fairfax County (zips: 22015, 22039) | 8% |
| Alexandria | 5% |
| Lake Ridge (zip: 22192) | 4% |
| Lorton (zip: 22079) | 4% |

Note: Zip codes listed indicate areas of concentrated interest. If no zips listed, no areas of concentration identified.

Q63. If more parking were available at VRE train stations, how likely would you be to take VRE at least 1-2 days a week?

# Metrorail Is Available to Half to Three-Fourths of Current Non-Users

**Question asked of all respondents who do not ride Metrorail.**




Q64. Is Metrorail available for at least a portion of your commute?

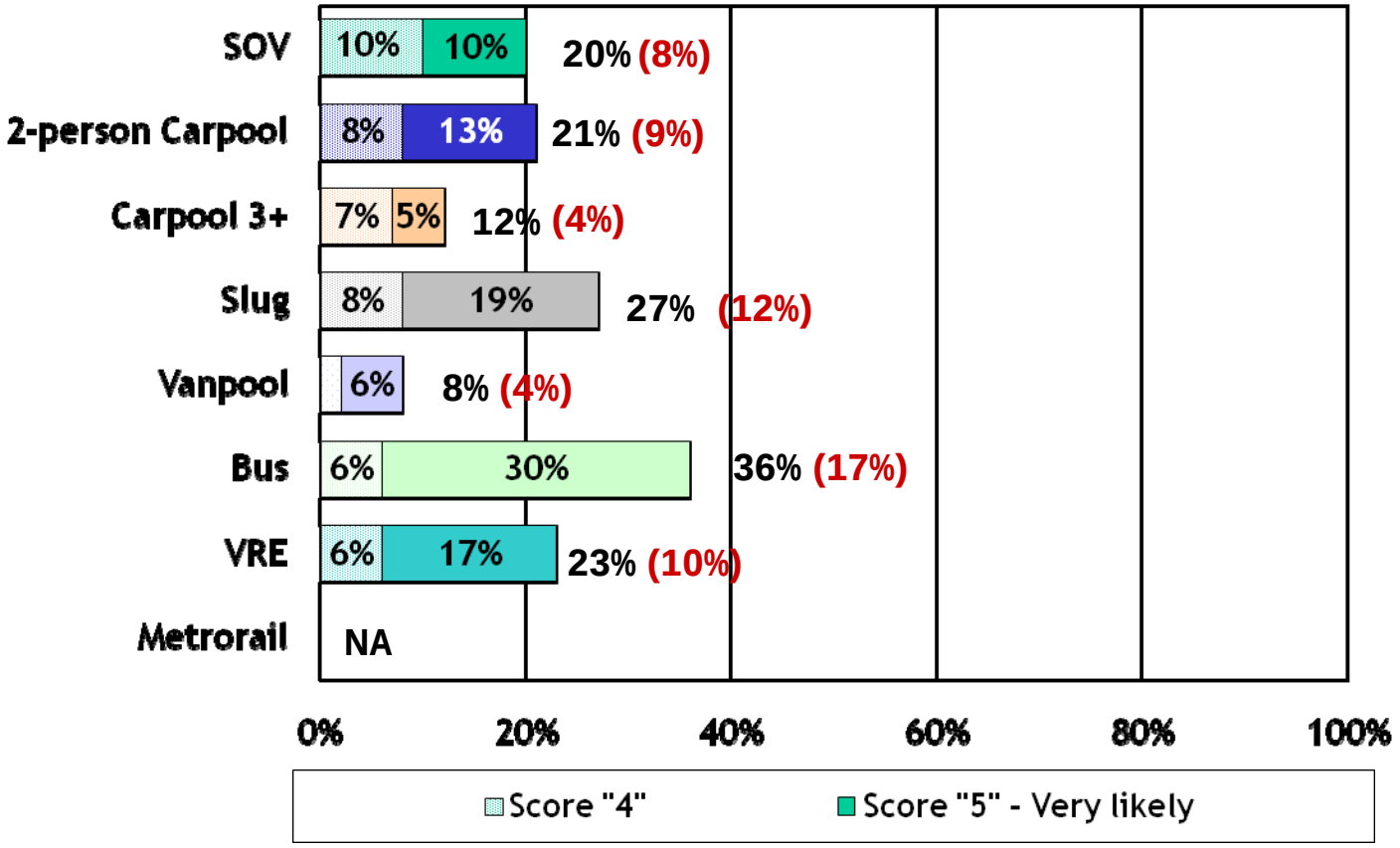


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=798
2-person carpool, n=118
Carpool 3+, n=228
Slug, n=590
Vanpool, n=268
Bus, n=379
VRE, n=494

# More Frequent Trains Could Enhance the Appeal of Metrorail to About One Out of Ten; Bus Riders Express the Greatest Interest

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not ride Metrorail and have Metrorail service available.**

Q66. If the schedule were revised so that trains came more often, how likely would you be to use Metrorail for your commute at least 1-2 days a week?

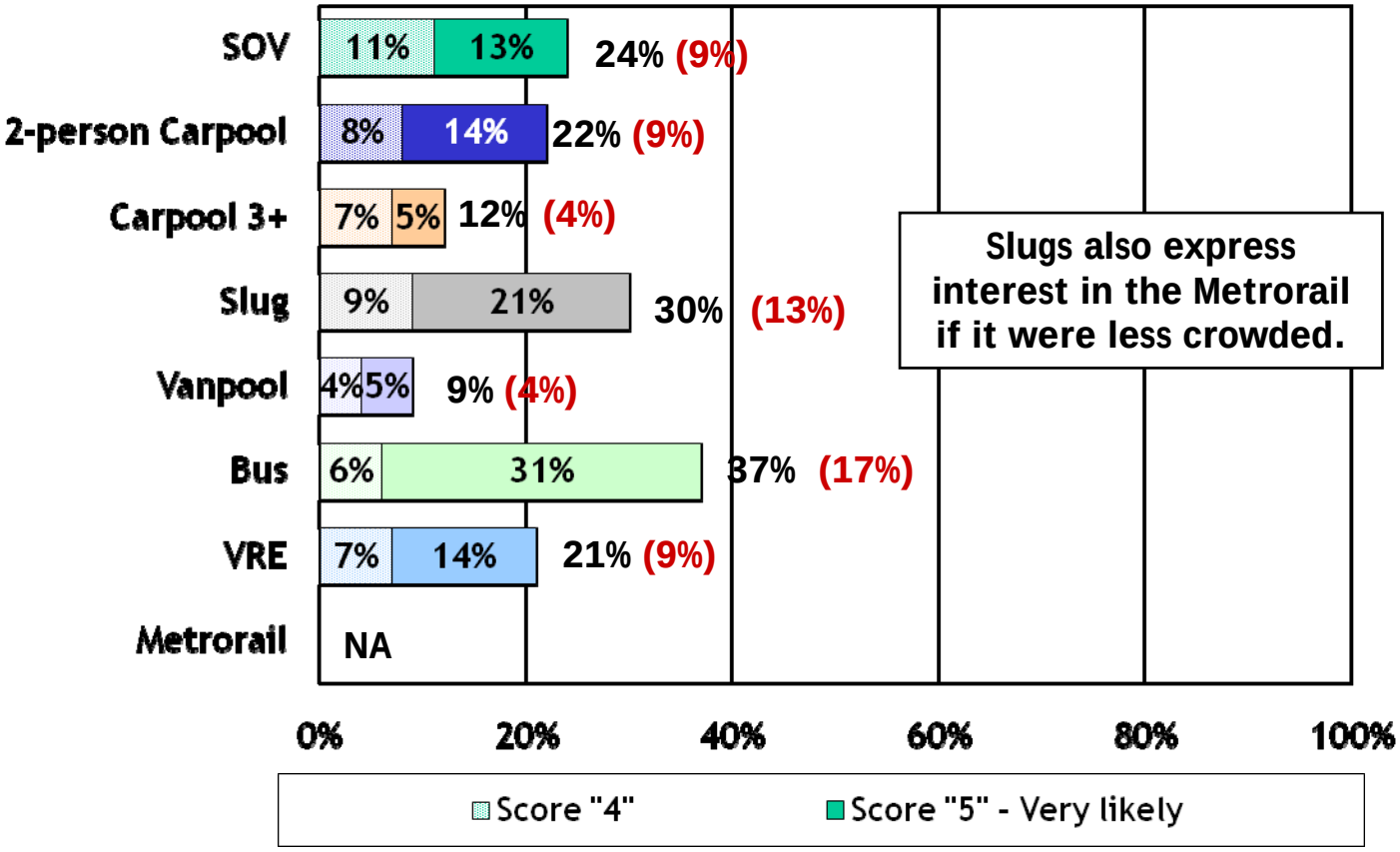


DRPT
Virginia Department of Rail and Public Transportation
The Smartest Distance Between Two Points

SOV, n=798
2-person carpool, n=118
Carpool 3+, n=228
Slug, n=590
Vanpool, n=268
Bus, n=379
VRE, n=494

# Less Crowded Trains Could Also Enhance the Appeal of Metrorail among Bus Riders

**Values in red font indicate total scores after discount demand factor has been applied.**




**Slugs also express interest in the Metrorail if it were less crowded.**

**Question asked of all who do not ride Metrorail and have Metrorail service available.**

Q67. If trains were less crowded, how likely would you be to use Metrorail for your commute at least 1-2 days a week?

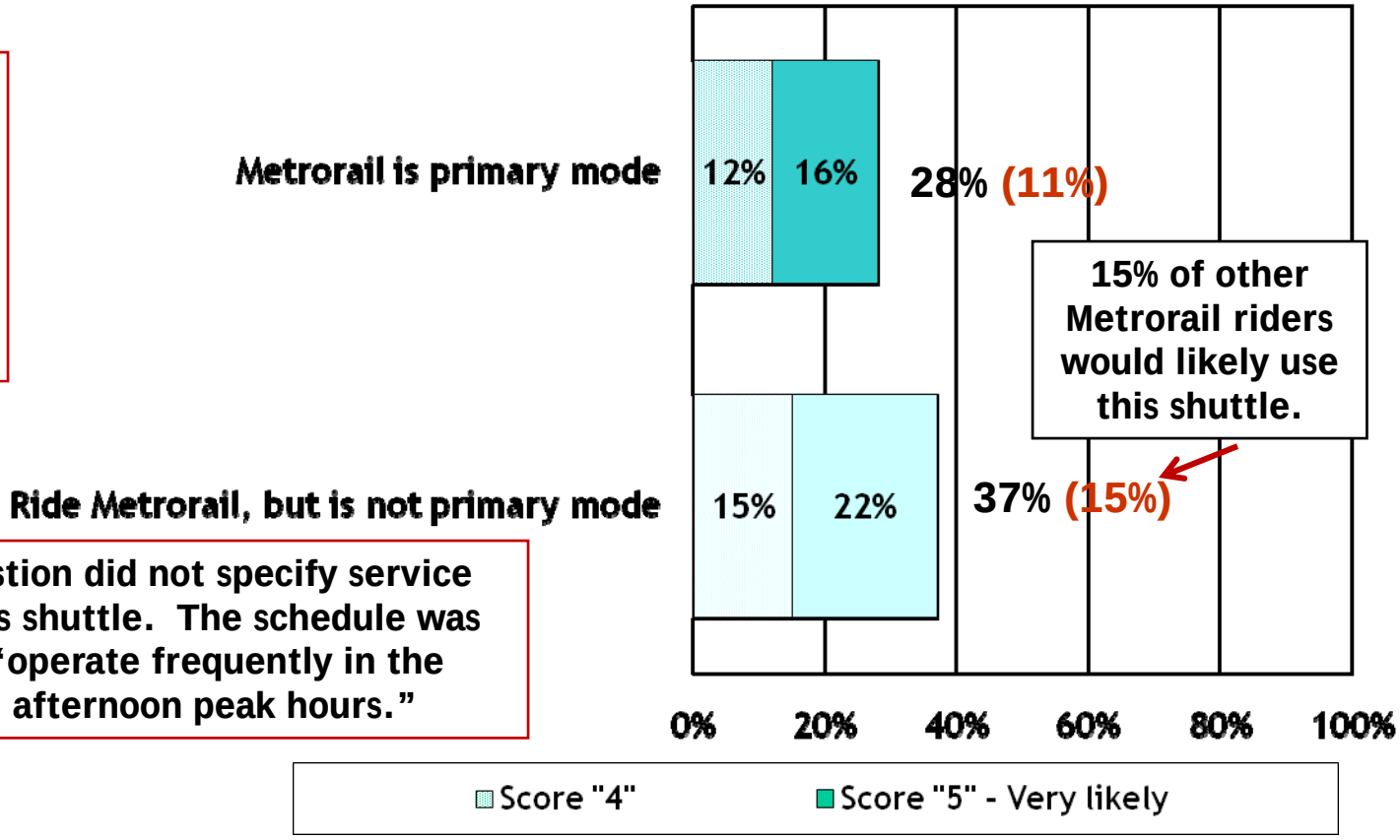


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

Metrorail is primary mode, n=185
Ride Metrorail, but is not primary mode, n=73

# About One Out of Ten Who Use Metrorail as Their Primary Commute Mode Would Take a Shuttle That Runs from the Metrorail Station to Their Destination

**Values in red font indicate total scores after discount demand factor has been applied.**




**Note: The question did not specify service schedule for this shuttle. The schedule was described as "operate frequently in the morning and afternoon peak hours."**

**Question asked of those who ride Metrorail – as primary mode and non-primary mode.**

Q68. Suppose that a shuttle bus service between the Metrorail train station and your place of work could operate frequently in morning and afternoon peak hours. How likely would you be to use this shuttle bus service?



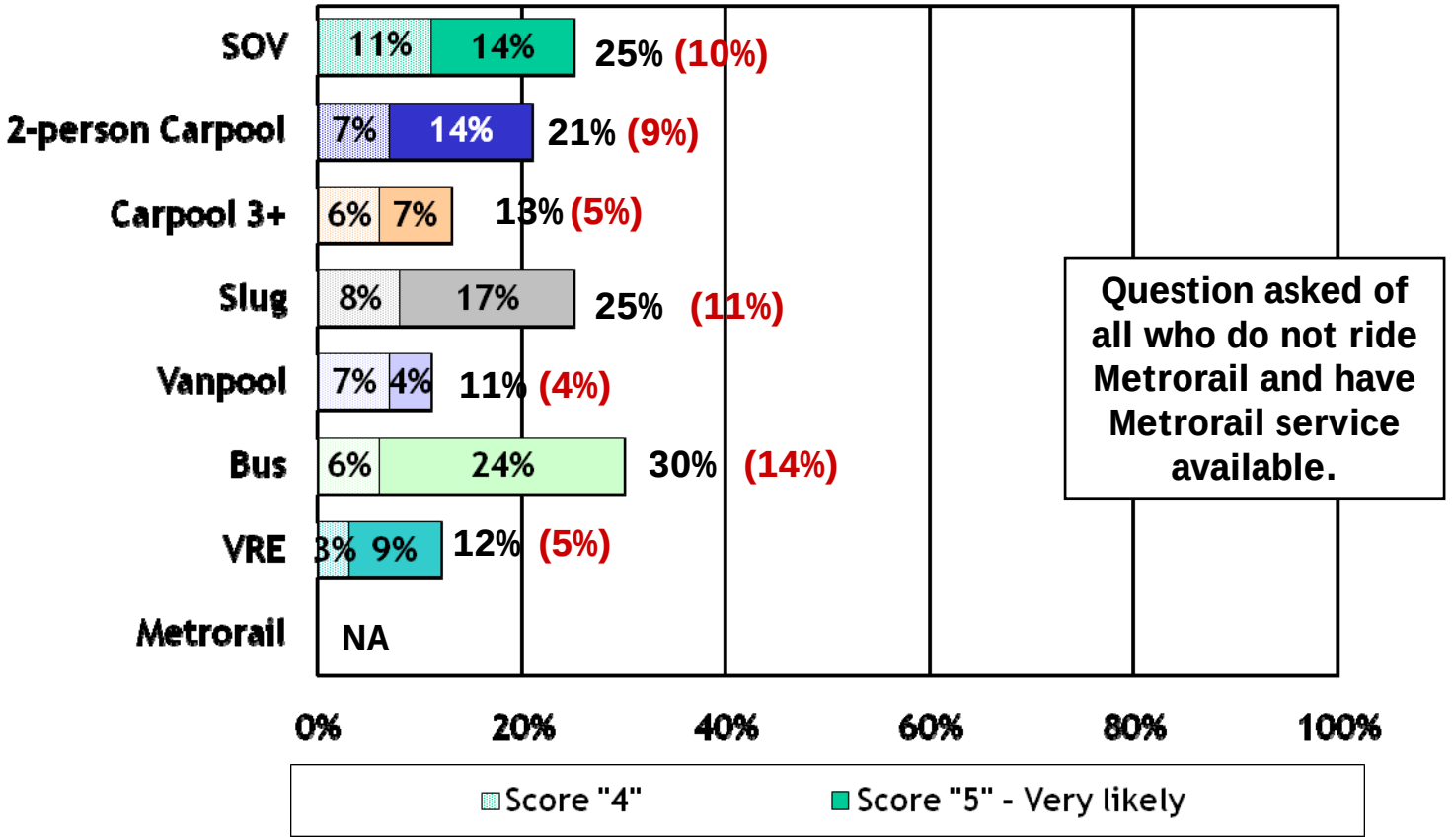
DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=798
2-person carpool, n=118
Carpool 3+, n=228
Slug, n=590
Vanpool, n=268
Bus, n=379
VRE, n=494

# Shuttle Bus to the Work Site Could Enhance the Appeal of Metrorail among about 10% of SOVers, Carpools of 2 People, and Sluggers and 14% of Bus Riders

**Values in red font indicate total scores after discount demand factor has been applied.**

Q69. Suppose that a shuttle bus service between the Metrorail train station and your commute destination (e.g., work) could operate frequently in morning and afternoon peak hours. How likely would you be to ride Metrorail if this shuttle bus service were offered?




**Question asked of all who do not ride Metrorail and have Metrorail service available.**

**Note: The question did not specify service schedule for this shuttle. The schedule was described as "operate frequently in the morning and afternoon peak hours."**



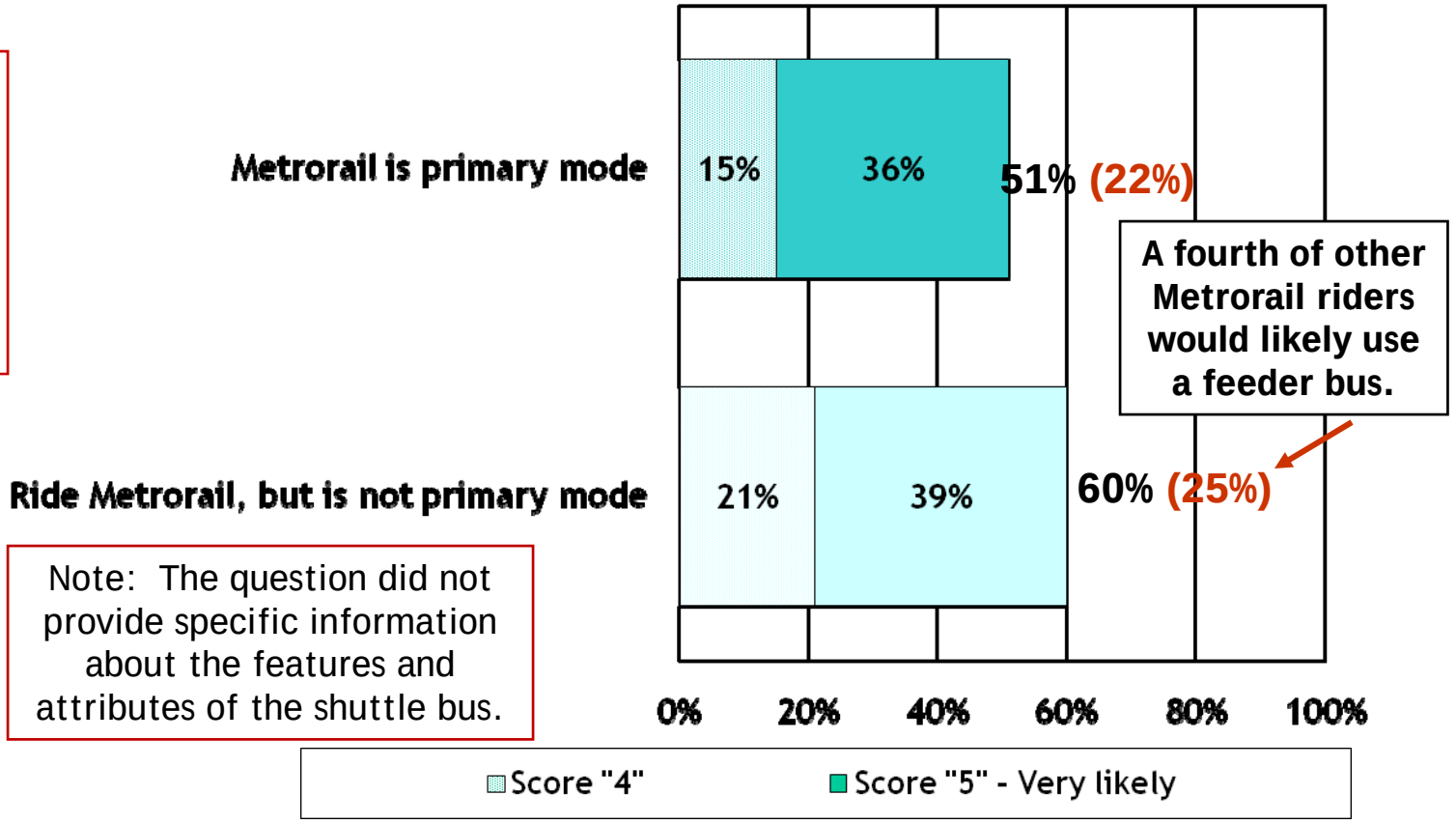
DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

# About One-Fourth Who Take Metrorail as Their Primary Commute Mode Would Likely Use a Feeder Bus from Their Neighborhood

Metrorail is primary mode, n=185
Ride Metrorail, but is not primary mode, n=73

**Values in red font indicate total scores after discount demand factor has been applied.**

**Question asked of those who ride Metrorail – as primary mode and non-primary mode.**




Note: The question did not provide specific information about the features and attributes of the shuttle bus.

Q70. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the Metrorail station. How likely would you be to ride this feeder bus if it operated in your neighborhood?

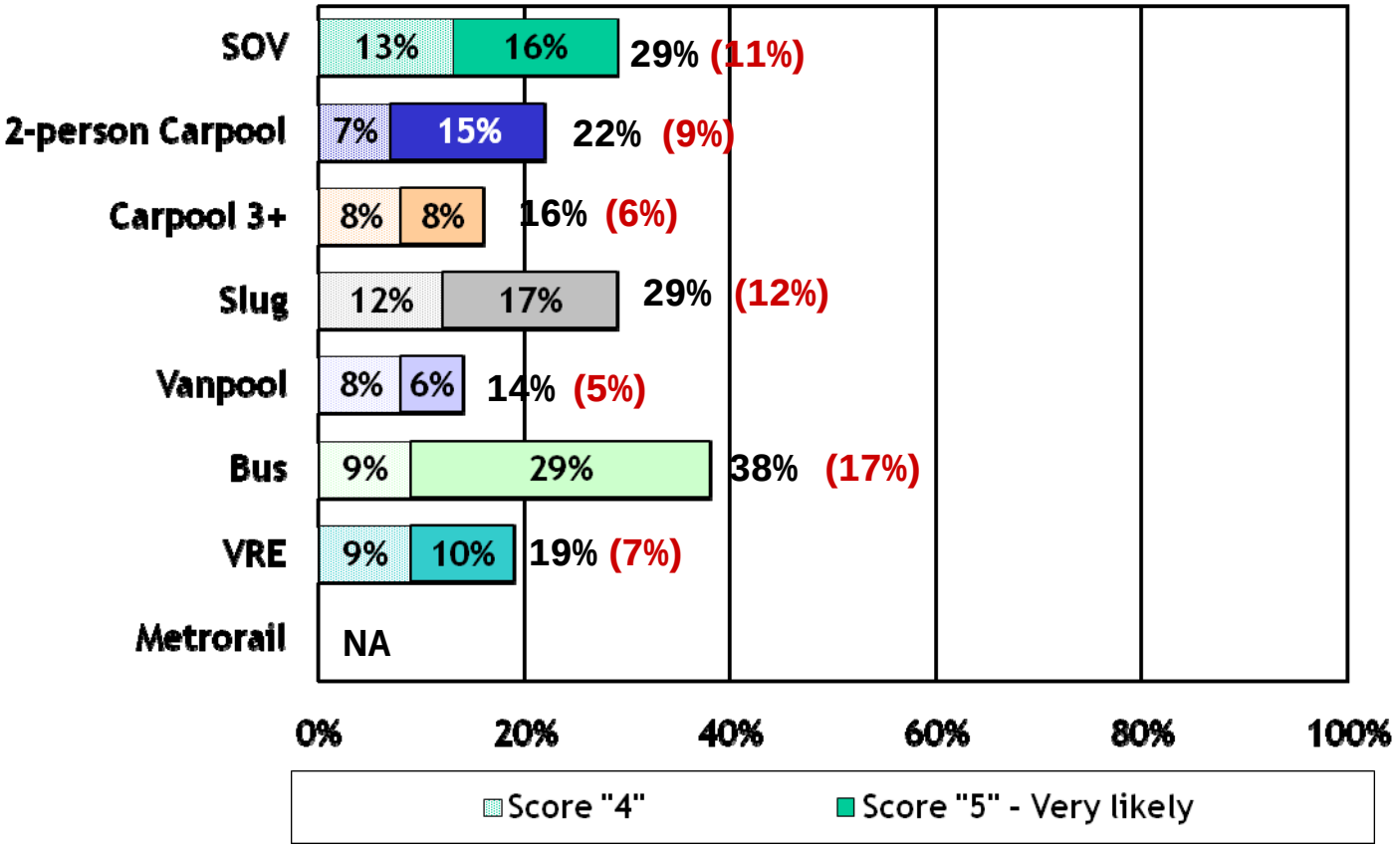


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=798
2-person carpool, n=118
Carpool 3+, n=228
Slug, n=590
Vanpool, n=268
Bus, n=379
VRE, n=494

# A Neighborhood Feeder Bus Would Most Increase the Appeal of Metrorail among SOVers, Sluggers, and, Especially, Bus Riders

**Values in red font indicate total scores after discount demand factor has been applied.**




**Question asked of all who do not ride Metrorail and have Metrorail service available.**

Q71. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the Metrorail station. How likely would you be to ride Metrorail at least 1-2 days a week if a feeder bus operated in your neighborhood?

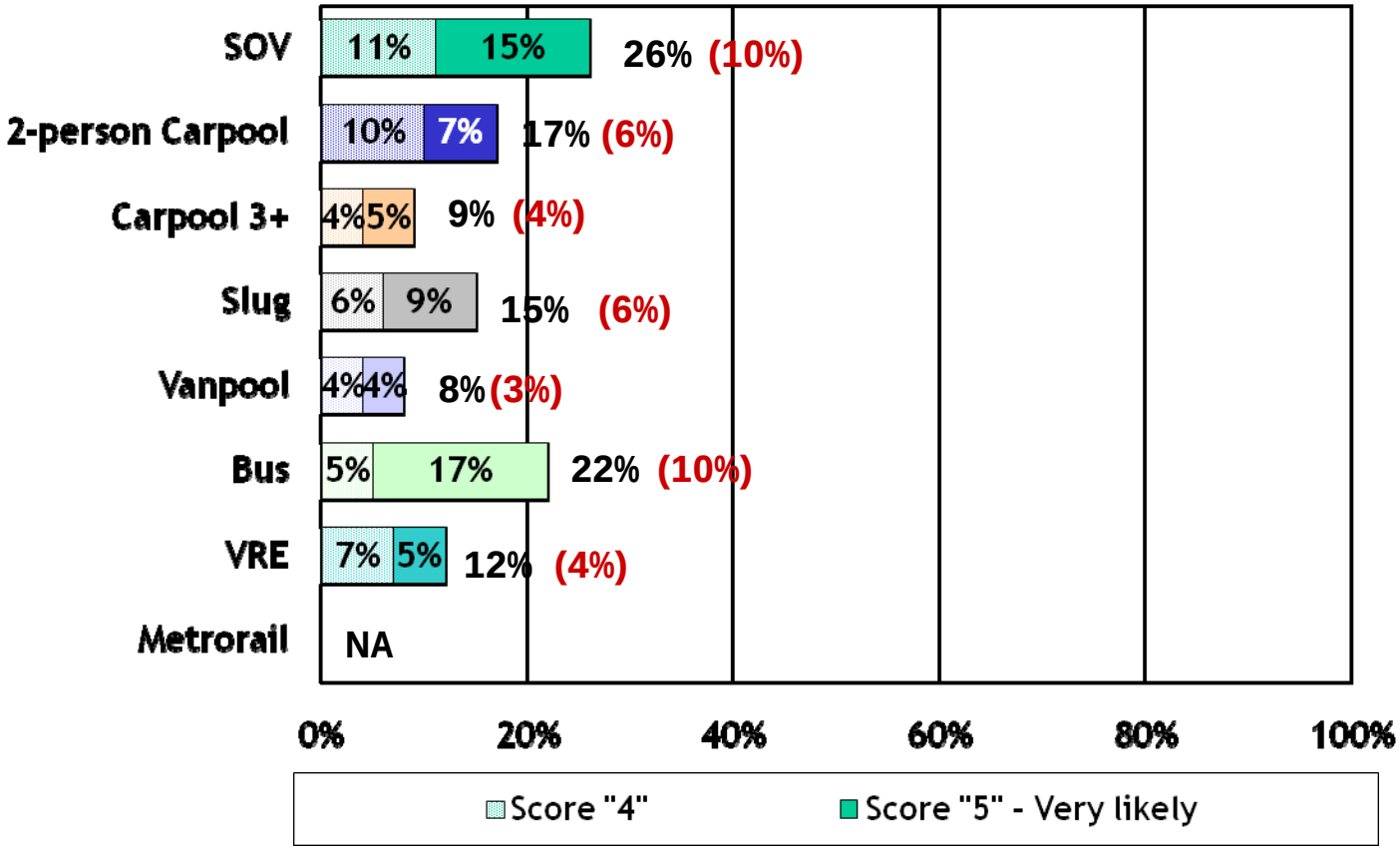


DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

SOV, n=798
2-person carpool, n=118
Carpool 3+, n=228
Slug, n=590
Vanpool, n=268
Bus, n=379
VRE, n=494

# More Parking at Metrorail Stations Would Be Most Likely to Increase Appeal of Metrorail among SOVers and Bus Riders

**Values in red font indicate total scores after discount demand factor has been applied.**




Q72. If more parking were available at Metrorail stations, how likely would you be to take Metrorail at least 1-2 days a week?

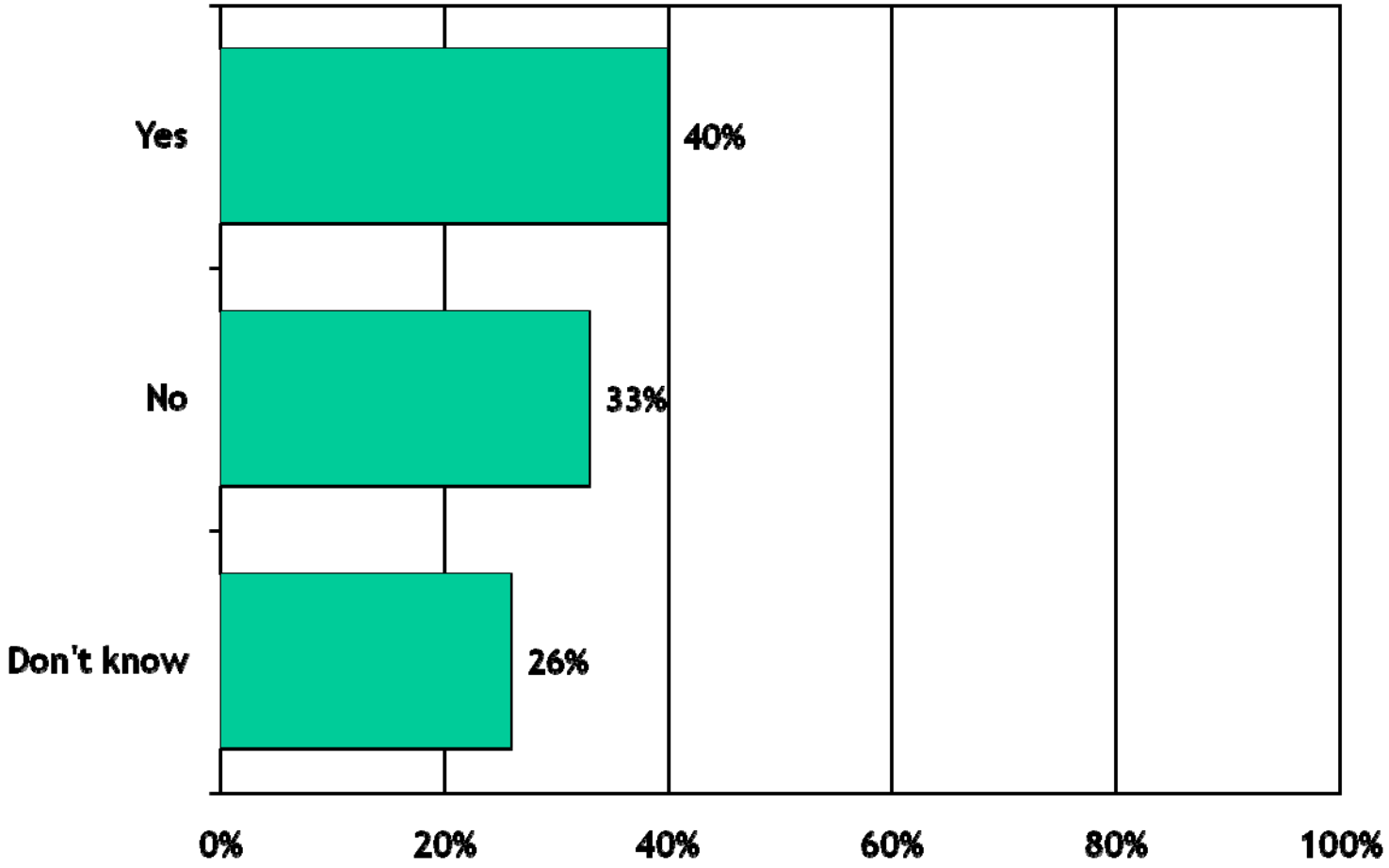
**Question asked of all who do not ride Metrorail and have Metrorail service available.**



DRPT Virginia Department of Rail and Public Transportation The Smartest Distance Between Two Points

# 40% of SOVers Currently Have a Park-and-Ride Lot or Some Other "Meeting Place" for Ridesharing Conveniently Located on their Commute

**Question asked only of SOVers.**




Q73. Is there a place such as a park-and-ride lot conveniently located on your commute where you could ever catch a carpool or vanpool or commuter bus?



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The Smartest Distance Between Two Points

n=809

**Proportions represent SOVers who said they do not have a convenient park-and-ride lot. These locations are those that have the greatest proportion of SOVers saying that there is no convenient park-and-ride lot.**

# Lack of a Park-and-Ride Lot Is Most Pronounced in Alexandria and Annandale

- Proportions Indicate Those Who Do Not Have Park-and-Ride Lot -

| | |
|---|---|
| Alexandria (zips: 22302, 22304) | 27% |
| Springfield (zips: 22015, 22150, 22151, 22152, 22153) | 14% |
| Arlington (zips: 22204, 22206) | 9% |
| Woodbridge [zips: 22191, 22192, 22193 (Dale City)] | 7% |
| Annandale (zip: 22003) | 6% |
| Fairfax County – Lincolnia (zip: 22312) | 5% |
| Lorton (zip: 22079) | 5% |
| Fairfax City (zip: 22032) | 4% |
| Springfield (22153) | 4% |
| Franconia (zip: 22315) | 4% |
| Fredericksburg (zip: 22408) | 4% |
| Stafford | 3% |

Note: Zip codes listed indicate areas of concentrated interest. If no zips listed, no areas of concentration identified.

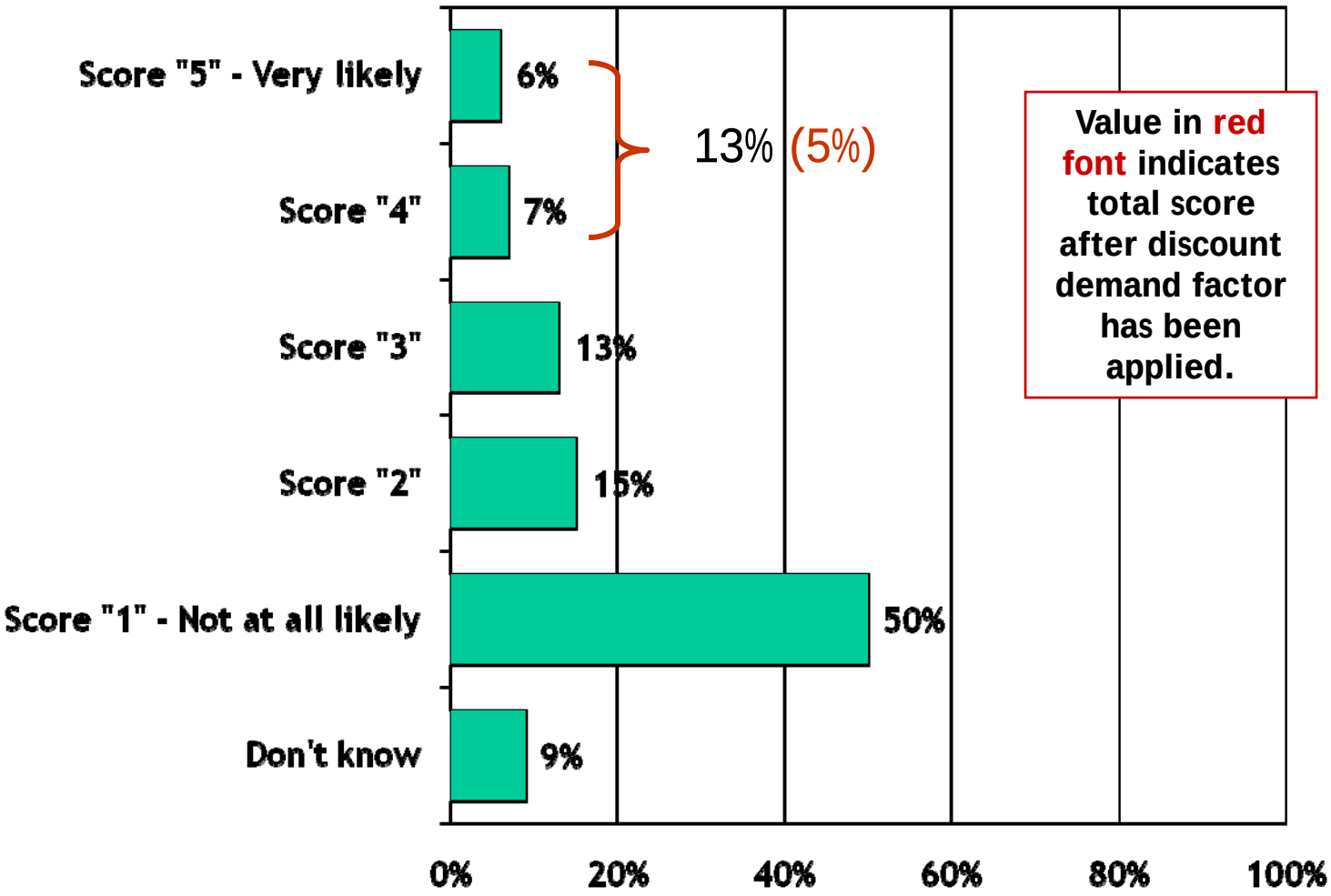
Q73. Is there a place such as a park-and-ride lot conveniently located on your commute where you could ever catch a carpool or vanpool or commuter bus?

n=464

# About 5% of SOVers without a Park-and-Ride Lot Would Use One if Available – and Use Another Form of Transportation at Least 1-2 Days a Week

**Question asked only of SOVers not aware of a park-and-ride lot on their commute.**

Q74. If a park-and-ride lot were conveniently located, how likely would you be to use it at least 1-2 days a week in order to use a form of transportation other than driving alone?





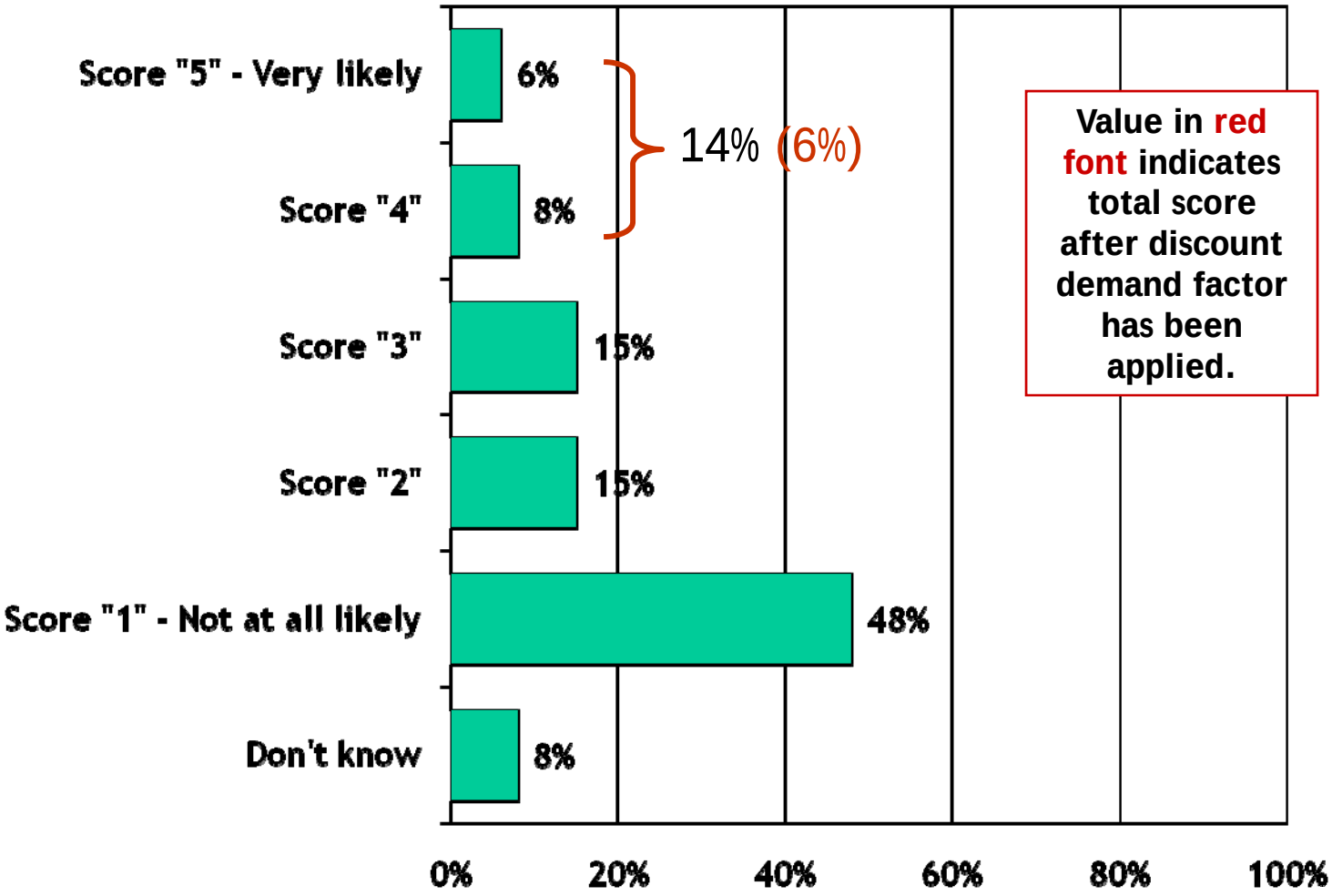

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Virginia Department of Rail and Public Transportation
The Smartest Distance Between Two Points

n=464

**Question asked only of SOVers not aware of a park-and-ride lot on their commute.**

Q75. Suppose that HOT lanes are built and a park-and-ride lot was located convenient for your commute. How likely would you be to use the park-and-ride lot to take advantage of free travel on the HOT lanes in a bus, vanpool, or three-person carpool?

# About the Same Proportion of SOVers without a Park-and-Ride Lot Would Use One if Available – In Order To Use the HOT Lanes

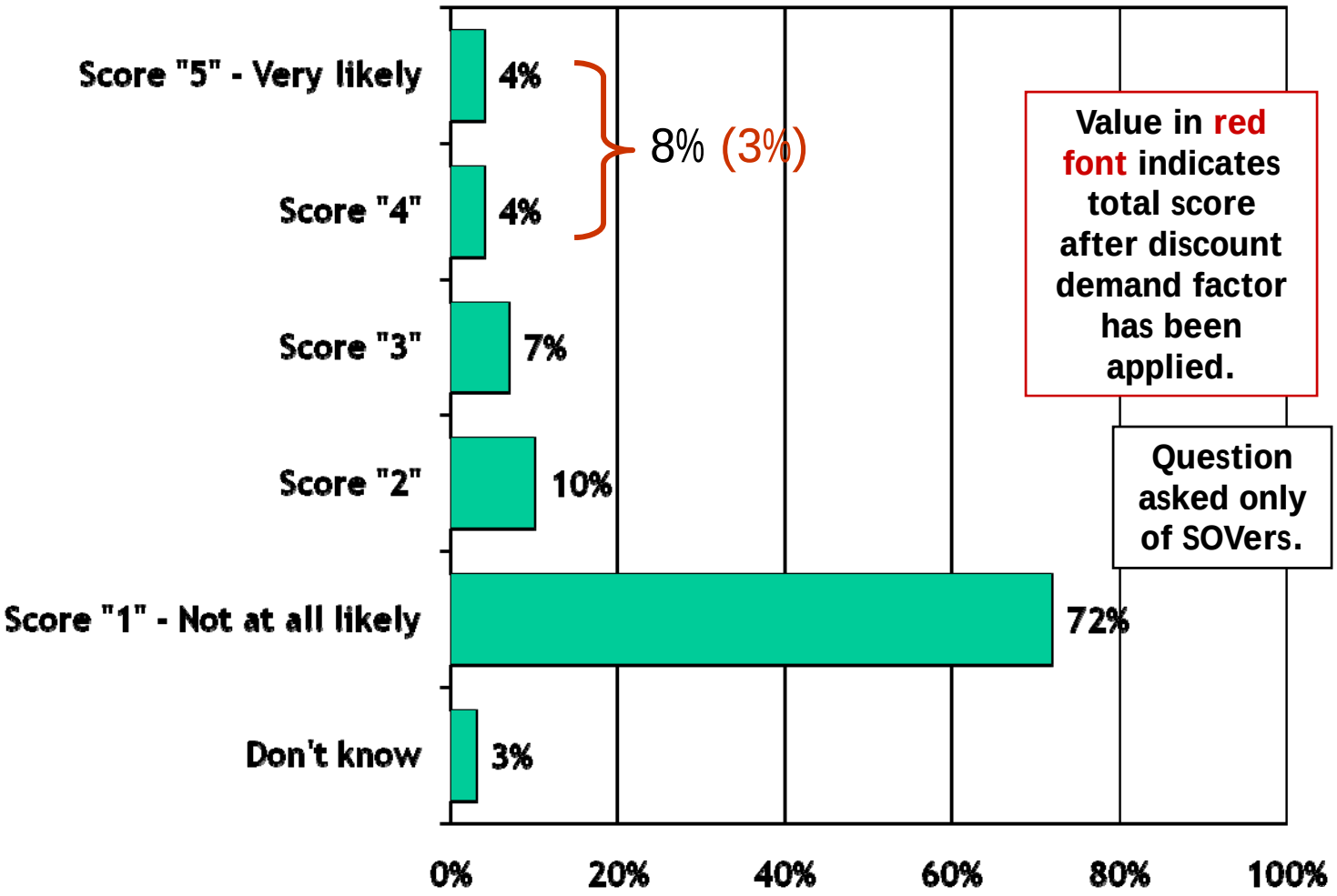





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Q77. Suppose you could pay to have a reserved parking space at a convenient park-and-ride lot. The cost of parking would be up to $5.00 per day and would be paid on a monthly basis. How likely would you be to pay for a reserved parking space at a park-and-ride lot in order to travel in a bus, vanpool, or three-person carpool and use the HOT lanes for no additional charge at least 1 or 2 days a week?

# Interest in a Paid and Reserved Parking Space Is Low



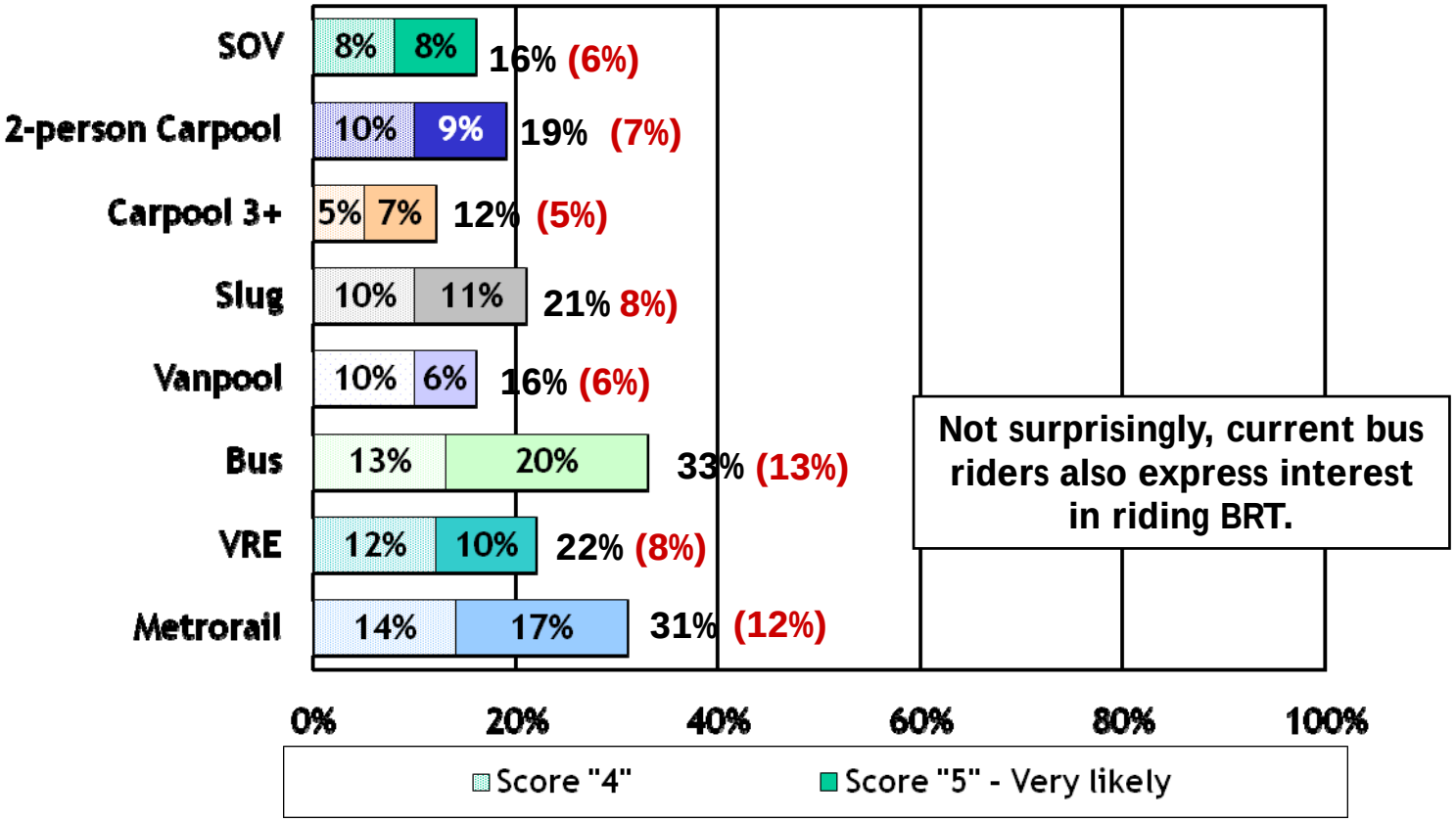



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# Among Non-Bus Riders, Interest in BRT Is Highest among Metrorail Riders

Values in red font indicate total scores after discount demand factor has been applied.

Question asked of all respondents.




Not surprisingly, current bus riders also express interest in riding BRT.

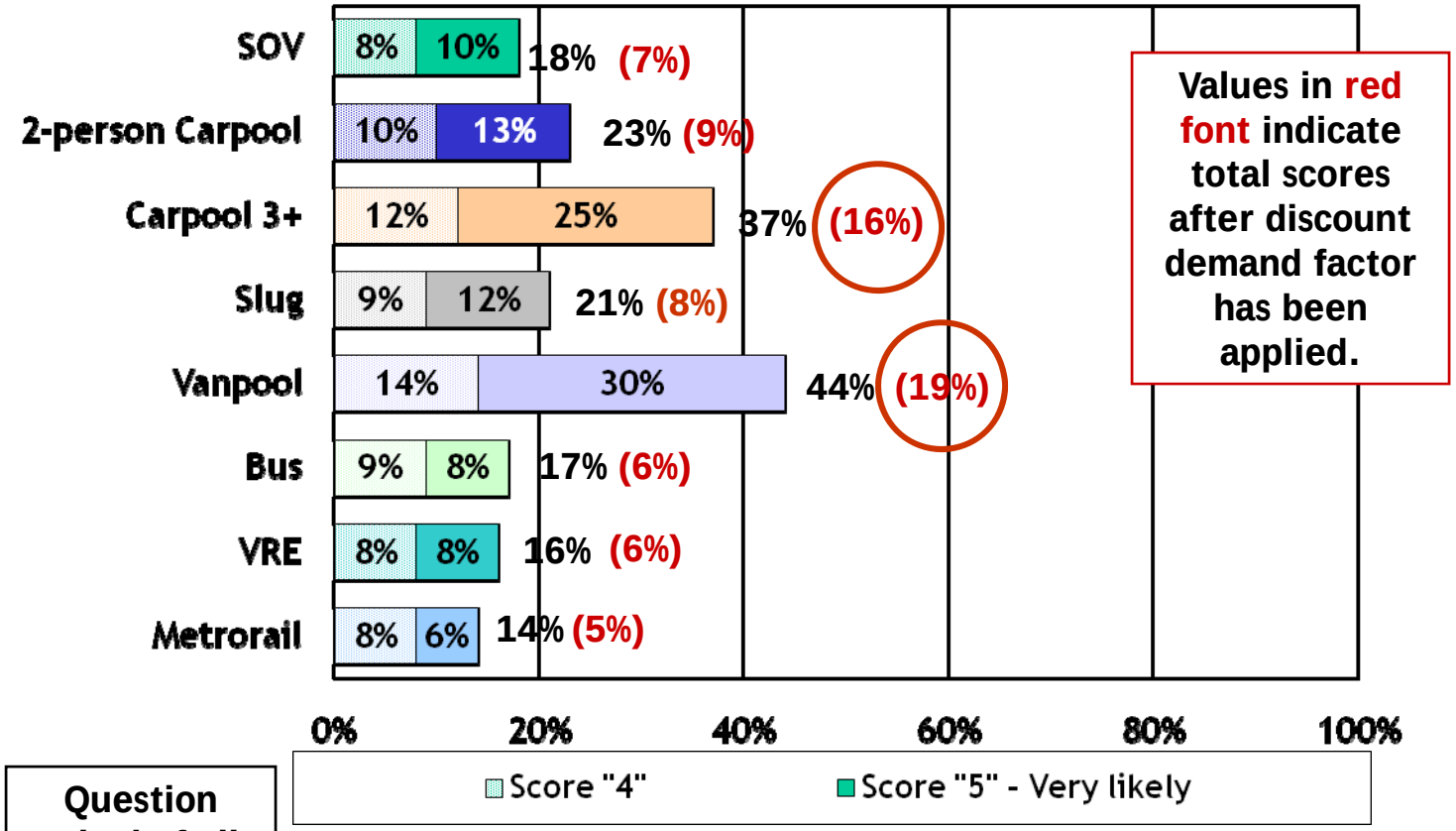
Q78. Suppose that Bus Rapid Transit (BRT) service became available in the general area of your commute. BRT offers frequent express service in comfortable vehicles serving station-like stops. How likely would you be to use this bus service for your commute at least 1-2 days a week?



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Q79. Suppose you could use a self-assisted, online ride-matching service to find a rideshare partner in order to use the HOT lanes. This service provides you with a list of commuters who live in your area, commute to the same area as you do and are also looking for a vanpool or carpool partner. You register for this service online and receive the information online. How likely would you be to use this type of ride-matching service if you wanted to carpool or vanpool and use the HOT lanes?

# Interest in an Online Ride-Matching Service Is Highest among Carpoolers of 3 or More Persons and Vanpools – Probably Those Commuters Who Have Experienced the Need to Find Ridesharing Partners




Values in red font indicate total scores after discount demand factor has been applied.

Question asked of all respondents.



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# TURF Analysis
## (Total Unduplicated Reach and Frequency)

- TURF analysis is used to identify the strongest program or service and determine its potential impact.
- The impact of other programs is assessed – one program at a time – in order of their strength.
- By summing the totals, a combined estimate can be calculated.

# Frequently Running Buses Is Most Likely to Convert SOVers to *Express Bus* Riders

Shuttle buses, feeder buses, and park-and-ride lots would add an additional small percentage to the total SOVers that could be converted by shorter headways. This suggests that the programs generally appeal to the same group of SOVers.

| | Buses come more often | Shuttle bus to destination | Feeder bus in neighborhood | Park-and-ride lot |
|---|---|---|---|---|
| Total SOVers | 30% | 3% | 1% | 1% |

Based on raw responses, these express bus programs would attract 35% of SOVers in total. With the discount demand factor applied, the proportion reduces to 13%.

# Shuttle Buses to/from Destination Would Influence the Most SOVers to Ride *VRE*

Adding trains, increasing parking at VRE stations, providing neighborhood feeder buses, and making more seats available on the trains would attract a minimal number of new SOVers beyond what shuttle buses would add.

| | Shuttle bus to/from destination | Trains added to come more often | More parking at VRE stations | Feeder bus in neighbor-hood | More seats available |
|---|---|---|---|---|---|
| Total SOVers | 16% | 3% | 2% | 1% | <1% |

Based on raw responses, these VRE programs would attract 22% of SOVers in total. With the discount demand factor applied, the proportion reduces to 8%.

# Neighborhood Feeder Buses Would Attract the Greatest Number of SOVers to *Metrorail*

Less crowded trains, more parking, shuttle to/from destination, and more frequent trains would all impact a few additional SOVers – but neighborhood feeder buses have the single greatest impact.

| Total SOVers | Feeder bus in neighbor-hood | Trains less crowded | More parking at Metrorail stations | Shuttle bus to/from destination | More frequent trains |
|---|---|---|---|---|---|
| | 23% | 5% | 3% | 3% | 1% |

Based on raw responses, these Metrorail programs would attract 35% of SOVers in total. With the discount demand factor applied, the proportion reduces to 11%.

# Conclusions and Implications

# Conclusion and Implication

**Conclusion:** As other research has shown, commuters in the study area have long commutes. Commuters in carpools of 3 or more, slugs, vanpoolers, bus riders and Metrorail riders all commute about an hour each morning. If this total time doubles when the afternoon commute is included, it represents a considerable portion of their daily lives.

**Implication:** Don't forget the importance of time in marketing and marketing messages for HOT lanes and TDM/transit alternatives. If the option can provide a time savings, explore the development of messages that incorporate time savings benefits.

# Conclusion and Implication

**Conclusion:** Of the potential benefits of HOT lanes tested, none is especially credible. Typically, 40% or less of commuters – regardless of their current mode – agree that HOT lanes will help traffic flow faster, create new commute opportunities, help commuters save time, or encourage drivers to pick up slugs.

**Implication:** In order to effectively promote or "market" HOT lanes, better understanding of the perceived benefits and how to communicate those benefits is necessary. Messages built around benefits that seem implausible are not credible or persuasive.

# Conclusion and Implication

**Conclusion:** Response to HOT lanes varies by area of residence. The most favorable response is posted for the southern part of the study area, including Spotsylvania and Stafford County. The most negative view is reported for Prince William County. Residents of the northern parts of the study area fall between these two extremes.

**Implication:** Communication and marketing messages for HOT lanes may benefit from an approach that targets specific messages to specific areas. Use data mining of the data in this study to help develop specific messages to be targeted to specific areas.

# Conclusion and Implication

**Conclusion:** Generally, vanpoolers tend to be more supportive of the HOT lanes than commuters using other primary modes. Nearly half of vanpoolers in the survey, 45%, said that they believed that the HOT lanes will help commuters save time. Additionally, two-thirds (64%) said that they will likely use the HOT lanes. This favorable view may stem from several sources: ability to continue commuting just as they are now, benefit from extension of HOV hours, as well as benefit of extension of the HOV lanes farther south.

**Implication:** Behavioral changes in response to the HOT lanes will probably be slight among vanpoolers. But, this group offers the opportunity to learn about generating support for the HOT lanes. Support may very well be related to the opportunity to continue the current mode of commuting, benefiting from longer HOV hours, and extension of the HOV lanes. Explore how these benefits can be used in marketing the HOT lanes.

# Conclusion and Implication

**Conclusion:** As many as one-fourth of commuters of various modes (e.g., SOV) do not know if express bus service is available for their commute. Some may not know if bus service is available. Others may not know if "express" bus service is available because they are not familiar with the term. Even current bus riders may not know if express bus service is available to them. One-fourth of current bus riders said that either express bus service was not available or that they did not know.

**Implication:** There is opportunity to promote express bus service through basic communications and education. Do not assume commuters are aware of the express bus option, understand what it is, or what its benefits are. Take care not to assume that industry terminology (e.g., "express bus") is used and understood by commuters.

# Conclusion and Implication

**Conclusion:** More frequent express bus service, earlier afternoon outbound service and later evening outbound service could help to convince up to 69% of current riders to continue or increase their ridership. Bicycle racks at park-and-ride lots or on buses have limited appeal.

**Implication:** Explore ways to offer more frequent express bus service, especially earlier outbound service in the afternoon and later evening outbound service. While bicycle racks may have limited impact on current riders, they may be easy to implement – and less costly than adding service. However, do not expect them to be primary reasons to continue or increase ridership. The role of bicycle racks may be more related to communications and imagery building for the transit provider – e.g., the bus company meets the needs of riders, provides flexibility, helps the environment, and so forth.

# Conclusion and Implication

**Conclusion:** More frequent buses, a neighborhood feeder bus, and a shuttle to/from their destination could all increase the attractiveness of the express bus to current non-riders. But, these programs may not be "additive" in terms of their effects. All three of these programs, for example, appeal to the same group of SOVers rather than each attracting a new group.

**Implication:** The "overlap" in the appeal of these programs does not necessarily mean that all or several of them should not be offered. Working together, the programs can provide a kind of synergy that works to ensure the likelihood that commuters who express interest in the programs will actually ride or try riding the express bus. But, it is important to manage expectations in terms of the power of these programs to attract new riders.

# Conclusion and Implication

**Conclusion:** Time is an especially important benefit for VRE riders. They have the longest average commute. Additionally, commuters for whom VRE is their primary mode of transportation as well as those who sometimes ride VRE say that more frequent service and information about whether the train is on time (by cell or email) could convince them to continue riding VRE or convince them to ride more frequently.

**Implication:** To ensure current VRE ridership continues, consider offering more frequent train service. Continue to provide on-time information and explore the use of technology to communicate with riders. Explore ways that VRE can enhance its image by "reminding" or educating riders and potential riders about how easy it is to get on-time information.

# Conclusion and Implication

**Conclusion:** Of 5 programs/services tested to increase VRE ridership, all offer some potential to attract new riders. But, just as with programs/services tested for express bus service, these programs/services tend to appeal to the same group of commuters. Thus, putting in place several of the programs/services would not increase ridership exponentially. "Shuttle service" to/from their destination was the single-most-powerful potential program/service enhancement.

**Implication:** Explore the opportunity to put in place shuttle service between the train station and work destinations in order to attract new riders to VRE. However, additional research in which specific service attributes are specified could help make implementation of this service more successful. In addition, don't overlook other opportunities: adding more trains, adding more parking at VRE stations, putting in place a neighborhood feeder bus system, and making more seats available. One or more of these additional programs could provide greater impetus to commuters to make the switch to VRE. Programs/services to offer more frequent service could be a "double" benefit in that they could help to attract new riders and enhance the appeal of VRE to ensure that current riders continue to ride and perhaps increase their ridership of VRE.

# Conclusion and Implication

**Conclusion:** Of 5 programs/services tested for Metrorail, neighborhood shuttle service tends to enhance the appeal of Metrorail to those who have Metrorail available but do not ride it currently. Eleven percent of current sluggers and SOVers say that they would be likely to ride Metrorail 1-2 days a week with a neighborhood shuttle. But, less crowded trains could also help. Nearly a quarter (24%) of current SOVers said they would ride Metrorail if trains were less crowded.

**Implication:** Explore the potential of offering neighborhood shuttle to increase the appeal of Metrorail. Additional research in which specific service attributes are specified could provide more precise understanding of the potential success of a neighborhood shuttle program. To the extent that trains become more crowded, consider the need to increase capacity so that trains are less crowded.

# Conclusion and Implication

**Conclusion:** SOVer interest in a paid and reserved parking space is low.

**Implication:** Do not pursue development of paid and reserved parking without further research.

# Conclusion and Implication

**Conclusion:** There is interest in an online ride-matching service. Stated likelihood of usage ranges from 14% among Metrorail riders to 44% among vanpoolers and 37% among commuters in carpools of 3 or more persons.

**Implication:** Consider further development of online ride-matching. Since those who may have had experience with ridematching or ridematching services have the greatest interest in using this online service, learn from this group of commuters. Carpoolers and vanpoolers seem to recognize the benefits of ridematching – especially an online service. Understand better how ridematching has helped these commuters. Identify and understand the benefits so that "ridematching" can be marketed to other commuters.

# Appendix: Hybrid Drivers

Hybrid, n=100
Gasoline, n=816

# Hybrid SOVers Tend to Have Slightly Longer Commutes than Do Gasoline Vehicle SOVers; The Two Commuter Groups Are About Equally Likely to Have Flexible Schedules

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Length of commute (average in minutes) | 55 minutes | 48 minutes |
| Length of commute (average in miles) | 33.9 miles | 24.3 miles |
| Flexibility in schedule | | |
| Yes | 57% | 56% |
| No | 42% | 44% |



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Hybrid, n=100
Gasoline, n=816

# Hybrid Drivers Are More Likely than Gasoline SOVers to Be Aware of the HOV Lanes, to Have a Convenient Entrance, and to Use the HOV Lanes

**71% of hybrid drivers use the HOV lanes 5 days a week**

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Aware of HOV lanes | 100% | 98% |
| Convenient entrance to HOV lanes | 93% | 65% |
| Use HOV lanes at least occasionally | 91% | 59% |

**The HOV lanes are more important to hybrid drivers than to drivers of gasoline vehicles. Similarly, dependability is more important to hybrid drivers. But, flexibility, time have to leave, parking, comfort and toll cost are more important to drivers of gasoline vehicles.**

Hybrid, n=100
Gasoline, n=816

Q23. Next, think abut what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip?

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Dependability | 93% | 80% |
| Time it takes | 93% | 92% |
| Arriving on time | 89% | 87% |
| Availability of HOV lanes | 89% | 34% |
| Being in control | 87% | 84% |
| Flexibility | 72% | 84% |
| Availability of transport if stay late/leave early | 78% | 80% |
| Time have to leave | 75% | 93% |
| Safety | 74% | 74% |
| Reducing stress | 69% | 69% |
| Parking at work/school | 65% | 52% |
| Comfort | 63% | 72% |
| Availability of transport during day | 60% | 61% |
| Cost of tolls | 55% | 40% |
| Fare cost | 53% | 49% |
| Price of gas | 49% | 52% |
| Time alone | 38% | 36% |
| Making productive use of commute time | 36% | 38% |
| Parking cost at work/school | 36% | 39% |
| Ability to find carpool partner | 15% | 13% |

95% of hybrid drivers are aware of the HOT lanes on I-95/I-395.

Proportions reported are those giving a "4" or "5" on a 1-5 scale where "5" means that they "agree strongly" with the statement.

Interpret with caution. Base size for hybrids is small.

# Hybrid Drivers Have Slightly Less Favorable Views of the HOT Lanes than Do Drivers of Gasoline Vehicles

Hybrid, n=100
Gasoline, n=816

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Disruption caused by construction will be worse than any benefit | 57% | 44% |
| HOT lanes will discourage drivers from picking up sluggers | 49% | 34% |
| HOT lanes will encourage drivers to pick up sluggers | 30% | 35% |
| HOT lanes will help commuters save time | 20% | 35% |
| HOT lanes will help traffic flow faster in general purpose lanes | 18% | 32% |
| HOT lanes will create new transit, vanpooling and carpooling opportunities | 20% | 33% |
| HOT lanes will be key in emergency and evacuation | 18% | 35% |
| HOT lanes will help traffic in existing HOV lanes | 17% | 27% |
| HOT lanes will benefit all commuters | 12% | 30% |
| HOT lanes will benefit the environment | 4% | 15% |
| HOT lanes will support region's economic vitality | 13% | 26% |
| HOT lanes will add too much growth and development | 46% | 25% |
| HOT lanes will help commuters spend less time commuting and more time enjoying life | 23% | 34% |

Hybrid, n=100
Gasoline, n=816

# Hybrid Drivers Who Would Use the HOT Lanes Would Be More Likely than Gasoline Drivers to Use the HOT Lanes 5 Days a Week

**Response to questions does not provide information about mode change or intent to pay toll.**

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Likelihood of using HOT lanes | 20% | 23% |
| **Number of days would use HOT lanes*:** | | |
| Occasionally – less than one day a week | 0% | 6% |
| 1-2 days a week | 0% | 11% |
| 3 days a week | 0% | 16% |
| 4 days a week | 4% | 10% |
| 5 days a week | 88% | 40% |
| It would vary | 4% | 13% |
| Don't know | 4% | 4% |

* Based to those who said they would use the HOT lanes.

Q39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute? Q40. How often would you use the HOT lanes during the week, Monday through Friday?

Hybrid, n=100
Gasoline, n=816

# Hybrid SOV Drivers Are About as Likely to Ride an Express Bus as SOVers Who Drive Vehicles with Gasoline Engines

**Values in red font indicate total scores after discount demand factor has been applied.**

**Proportions reported are those giving a "4" or "5" on a 1-5 scale where "5" means "very likely."**

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Likelihood of riding express bus if buses came more often | 30% (12%) | 30% (12%) |
| Likelihood of riding express bus if neighborhood feeder | 25% (9%) | 24% (10%) |
| Likelihood of riding express bus if shuttle to/from destination | 23% (9%) | 24% (10%) |

Q49. If the schedule were revised so that express buses came more often, how likely would you be to ride an express bus at least 1-2 days a week? Q50. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to an express bus stop. How likely would you be to ride an express bus at least 1-2 days a week if such a feeder bus service operated? Q51. Suppose that a shuttle bus service could operate frequently in the morning and afternoon peak hours between the express bus drop-off point and your commute destination. How likely would you be to ride an express bus at least 1-2 days a week if such a shuttle bus service operated?

Hybrid, n=100
Gasoline, n=816

# Hybrid Drivers Express Less Interest in Riding VRE than Do Drivers of Gasoline Vehicles

**Values in red font indicate total scores after discount demand factor has been applied.**

**Proportions reported are those giving a "4" or "5" on a 1-5 scale where "5" means "very likely."**

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Likelihood of riding VRE if trains came more often | 6% (2%) | 20% (8%) |
| Likelihood of riding VRE if more seats | 5% (2%) | 19% (7%) |
| Likelihood of riding VRE if shuttle to/from destination | 13% (5%) | 27% (11%) |
| Likelihood of riding VRE if neighborhood shuttle | 14% (6%) | 26% (10%) |
| Likelihood of riding VRE if more parking | 9% (3%) | 18% (9%) |

Q57. If additional VRE trains were added so that they came more often, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week? Q58. If VRE trains had more seats available, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week? Q59. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to take this shuttle bus? Q60. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to ride VRE if this shuttle bus service were offered? Q62. Suppose a shuttle feeder bus could operate frequently in your neighborhood that would circulate and connect to the VRE train station. How likely would you be to use this feeder bus and take VRE at least 1-2 days a week? Q63. If more parking were available at VRE train stations, how likely would you be to take VRE at least 1-2 days a week?

Hybrid, n=100
Gasoline, n=816

# Hybrid Drivers Also Express Less Interest in Riding Metrorail than Do Drivers of Gasoline Vehicles

**Values in red font indicate total scores after discount demand factor has been applied.**

**Proportions reported are those giving a "4" or "5" on a 1-5 scale where "5" means "very likely."**

| | SOV: Hybrid | SOV: Gasoline |
|---|---|---|
| Likelihood of riding Metrorail if trains came more often | 9% (3%) | 20% (8%) |
| Likelihood of riding Metrorail if less crowded | 9% (4%) | 24% (9%) |
| Likelihood of riding Metrorail if shuttle to/from destination | 10% (4%) | 25% (10%) |
| Likelihood of riding Metrorail if neighborhood feeder | 14% (5%) | 29% (11%) |
| Likelihood of riding Metrorail if more parking | 12% (5%) | 26% (10%) |

Q66. If the schedule were revised so that trains came more often, how likely would you be to use Metrorail for your commute at least 1-2 days a week? Q67. If trains were less crowded, how likely would you be to use Metrorail for your commute at least 1-2 days a week? Q69. Suppose that a shuttle bus service between the Metrorail train station and your commute destination (e.g., work) could operate frequently in morning and afternoon peak hours. How likely would you be to ride Metrorail if this shuttle bus service were offered? Q71. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the Metrorail station. How likely would you be to ride Metrorail at least 1-2 days a week if a feeder bus operated in your neighborhood? Q72. If more parking were available at Metrorail stations, how likely would you be to take Metrorail at least 1-2 days a week?

# Appendix: Questionnaire

**I-95/I-395 Transit/TDM Study: Questionnaire**

**August 9, 2007 (Final)**

*INTRODUCTION*

Thank you for participating in this important research about transportation issues along the I-95/I-395 corridor from Fredericksburg to Washington, DC. This research is being conducted on behalf of the Virginia Department of Rail and Public Transportation (DRPT). All of your responses will be kept strictly confidential. If you have any questions or would like additional information about this research, please contact the Southeastern Institute of Research at 1-804-358-8981.

Instructions for completing this survey:

For most questions, simply click your response. In addition, there are places where you may add your specific comments. If you mistakenly skip a question, you will be prompted for an answer. You will not be able to move ahead to other questions until that question is answered.

This survey can be completed in about 15 minutes, but may take longer should you wish to add comments. If you are unable to complete this survey in one sitting, close the window with the survey. Then, when you are ready to continue, re-start the survey by clicking on the link you used to access the survey the first time. It will take you to the first unanswered question.

Once you have completed the survey, click the final "continue" box to submit your answers. At that point, the link will no longer be active, so you will not be able to review your answers or the survey again. Prior to clicking the final "continue" to submit your answers, you may review and change your answers.

There is a link on every page that you can click to get help if you have any problems or questions.

Again, thank you for participating in this research.

In order to begin the survey, please enter the password listed on the postcard sent to you. The password must be entered in all CAPITAL letters.

Password:

____ ____ ____ ____ ____



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*I. SCREENING AND CURRENT TRIP ATTRIBUTES*

1. In what year were you born?

____ ____ ____ ____

**(MUST BE BETWEEN THE AGES OF 18 AND 65 TO QUALIFY.)**

2. Typically, how many days a week (Monday through Friday) do you travel in the I-95/I-395 corridor in the **morning**, between 5:00 a.m. and 10:00 a.m.?

1. 1-2 days a week → **THANK & TERMINATE**
2. 3 days a week
3. 4 days a week
4. 5 days a week
5. None → **THANK & TERMINATE**
6. Occasionally - less than once a week → **THANK & TERMINATE**
7. Don't know/not certain → **THANK & TERMINATE**

3. What is the main purpose of your morning travel in the I-95/I-395 corridor?
   1. Going to work
   2. Going to school
   3. Going to work and school
   4. Something else → **THANK & TERMINATE**

4. What direction are you headed when you travel in the I-95/I-395 corridor on your morning commute between 5:00 a.m. and 10:00 a.m.?

   1. North
   2. South → **THANK & TERMINATE**
   3. Don't know/not certain → **THANK & TERMINATE**

5. About what time do you typically begin your commute (i.e., leave your house) in the I-95/I-395 corridor in the morning?

1. Prior to 5:00 a.m. → **THANK & TERMINATE**
2. 5:00-5:30 a.m.
3. 5:31-6:00 a.m.
4. 6:01-6:30 a.m.
5. 6:31-7:00 a.m.
6. 7:01-7:30 a.m.
7. 7:31-8:00 a.m.
8. 8:01-8:30 a.m.
9. 8:31-9:00 a.m.
10. 9:01-9:30 a.m.
11. 9:31-10:00 a.m.
12. After 10:00 → **THANK & TERMINATE**

5a. Do you have flexibility in your daily departure time (that is, can you vary your arrival time at work/school)?

1. Yes
2. No
9. Don't know

6. Please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. In the table below, please enter the number of weekdays you typically use each of the listed types of transportation as your **primary** mode for your **morning** commute. If you use more than one type on a single day (e.g., walk to the bus stop, then ride the bus), please count only the type you use for the **longest distance part** of your commute trip. (If you do not use a particular form of transportation for your morning commute, please enter a 0 for that form of transportation.)

| | *Number of Days Used (Enter 0 to 5)* |
|---|---|
| 1. Drive alone | |
| 2. Travel in a pre-arranged carpool with 1 other person either as the driver or as a passenger | |
| 3. Travel in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger | |
| 4. Travel in an informal carpool ("slugging" - picking up or picked up passengers to use the HOV lanes) | |
| 5. Travel in a vanpool as either the driver or as a passenger | |
| 6. Ride a bus | |
| 7. Take Metrorail | |
| 8. Take Virginia Railway Express (VRE) | |
| 9. Other _____ | |
| ***TOTAL WEEKDAYS*** | ***(SUM OF 1-9)*** |

**(VALIDATION CHECK: TOTAL ALIGNS WITH ANSWER TO Q2 (i.e., 3, 4, or 5)**

**(IF CHOICE "2", CHOICE "3", CHOICE "4", OR CHOICE "5" IS GREATER THAN 0 AT Q6 ASK Q6a)**

6a. What is your typical role when carpooling or vanpooling?

1. I am typically the driver
2. I am typically a passenger
3. I alternate roles as driver and passenger
9. Don't know/prefer not to answer

**(IF CHOICE "1" IS GREATER THAN 0 AT Q6 OR ANSWER "1" at Q6a, ASK Q6b)**

6b. When you drive, what type of vehicle do you typically use on I-95/I-395?

1. Gasoline-only or diesel powered vehicle
2. Gasoline-electric hybrid vehicle registered before July 1, 2006 (allows me to travel on the HOV lanes)
3. Gasoline-electric hybrid vehicle registered after July 1, 2006
9. Don't know/prefer not to answer

**(IF CHOICE "6" IS GREATER THAN 0 AT Q6, ASK Q7. OTHERS SKIP TO Q8A.)**

7. Please identify the specific bus line that you use for your morning commute?

1. ART (Arlington Transit)
2. CUE (City of Fairfax)
3. DASH (Alexandria Transit Co.)
4. Fairfax Connector
5. FRED (Fredericksburg Regional Transit)
6. GEORGE (City of Falls Church)
7. Loudoun County Transit Service
8. Martz
9. Metrobus/WMATA
10. PRTC/OmniLink/OmniRide/OmniBus
11. Quick's
12. TAGS Bus
13. Other

**(IF ANSWERED "13" AT Q7, ASK Q7A. OTHERS SKIP TO INSTRUCTIONS BEFORE Q7A-1.)**

7A. What bus line is that?

_____

_____

**(IF CHOICE "7" IS GREATER THAN 0 AT Q6, ASK Q7A-1. OTHERS SKIP TO Q7B.)**

7A-1. At what Metrorail station do you typically begin the rail portion of your commute?

1. Pentagon
2. Pentagon City
3. Crystal City
4. Ronald Reagan Washington National Airport
5. Braddock Road
6. King Street
7. Eisenhower Avenue
8. Huntington
9. Van Dorn Street
10. Franconia-Springfield
11. Other station

**(IF ANSWERED "11" AT Q7A-1, ASK Q7A-2. OTHERS SKIP TO Q7B.)**

7A-2. What station is that?

_____

**(IF CHOICE "8" IS GREATER THAN 0 AT Q6, ASK Q7B-1. OTHERS SKIP TO Q8.)**

7B-1. At what train station do you typically begin the rail portion of your commute?

1. Union Station
2. L'Enfant Plaza
3. Crystal City
4. Alexandria (King Street)
5. Manassas Line – Backlick Road
6. Manassas Line – Rolling Road
7. Fredericksburg Line – Franconia/Springfield
8. Fredericksburg Line – Lorton
9. Fredericksburg Line – Woodbridge
10. Fredericksburg Line – Rippon
11. Fredericksburg Line – Quantico
12. Fredericksburg Line – Brooke
13. Fredericksburg Line – Leeland
14. Fredericksburg Line – Fredericksburg
15. Other station

**(IF ANSWERED "15" AT Q7B-1, ASK Q7B-2. OTHERS SKIP TO Q8.)**

7B-2. What station is that?

_____

**(IF CHOICE 6 IS GREATER THAN 0 AT Q6 ASK Q8.)**

8. How do you get to the bus service that you use for your morning commute?

1. Drive alone
2. Drive with one or more people
3. Get dropped off
4. Take another bus
5. Walk
6. Bicycle
7. Other

**(IF CHOICE "7" IS GREATER THAN 0 AT Q6 [METRORAIL], ASK Q8A-1.)**

8A-1. How do you get to the Metrorail for your morning commute?

1. Drive alone
2. Drive with one or more people
3. Get dropped off
4. Take a bus
5. Walk
6. Bicycle
7. Other

**(IF CHOICE "8" IS GREATER THAN 0 AT Q6 [VRE COMMUTER], ASK Q8A-2.)**

8A-2. How do you get to the VRE train for your morning commute?

1. Drive alone
2. Drive with one or more people
3. Get dropped off
4. Take a bus
5. Walk
6. Bicycle
7. Other

**(IF CHOICE "6" IS GREATER THAN 0 AT Q6 [BUS], ASK Q8B-1.)**

8B-1. How do you typically get from the bus drop-off to the final destination of your morning commute (if more than one method used, please indicate the one you use for the longest distance).

1. Take another public bus (e.g., Metrobus)
2. Take rail transit (e.g., Metrorail)
3. Take a private shuttle bus
4. Walk
5. Bicycle
6. Other

**(IF CHOICE "7" IS GREATER THAN 0 AT Q6 [METRORAIL], ASK Q8B-2.)**

8B-2. How do you typically get from the Metrorail train to the final destination of your morning commute (if more than one method used, please indicate the one you use for the longest distance).

1. Take public bus (e.g., Metrobus)
2. Take a private shuttle bus
3. Walk
4. Bicycle
5. Other

**(IF CHOICE "8" IS GREATER THAN 0 AT Q6 [VRE COMMUTER], ASK Q8B-3.)**

8B-3. How do you typically get from the VRE train to the final destination of your morning commute (if more than one method is used, please indicate the one you use for the longest distance.)

1. Take public bus (e.g., Metrobus)
2. Take rail transit (e.g., Metrorail)
3. Take a private shuttle bus
4. Walk
5. Bicycle
6. Other

9. What entrance to I-95/I-395 do you use on your morning commute?

1. I-95 Exit 118 – Route 606 – Thornburg
2. I-95 Exit 126 – US Route 1, US Route 17 SB – Fredericksburg / Massaponax
3. I-95 Exit 130 – VA Route 3 – Fredericksburg / Culpeper
4. I-95 Exit 133 – US Route 17 BN – Warrenton
5. I-95 Exit 136 – Route 627 / US Route 1
6. I-95 Exit 140 – Route 630 – Stafford
7. I-95 Exit 143 – US Route 1 – Aquia; Route 610 – Garrisonville
8. I-95 Exit 148 – Russell Road – Marine Corps Base Quantico
9. I-95 Exit 150 – Route 619 – Triangle, Quantico
10. I-95 Exit 152 – VA Route 234 – Dumfries, Manassas
11. I-95 Exit 156 – Route 784 – Dale City, Rippon Landing, Potomac Mills
12. I-95 Exit 158 – Route 3000 – Prince William Parkway / Woodbridge,Manassas
13. I-95 Exit 160 – VA Route 123 – Woodbridge, Occoquan
14. I-95 Exit 163 – Route 642 – Lorton
15. I-95 Exit 166 – Route 7100 – Fairfax County Parkway / Newington, Ft. Belvoir
16. I-95 Exit 167 – Backlick Road, Fullerton Road
17. I-95 Exit 169 – Route 644 – Springfield, Franconia
18. I-95 Exit – Route 7900 – Franconia-Springfield Parkway HOV Ramp
19. I-95 Exit 170 – Capital Beltway I-495
20. I-395 Exit 2 – Route 648 – Edsall Road
21. I-395 Exit 3 – VA Route 236 – Duke St, Little River Turnpike
22. I-395 Exit 4 – Seminary Road
23. I-395 Exit 5 – VA Route 7 – King Street
24. I-395 Exit 6 – Quaker Lane – Shirlington
25. I-395 Exit 7 – VA 120 – Glebe Road
26. I-395 Exit 8 – VA 27 – Washington Blvd (fr Columbia Pike)
27. I-395 Exit 10 – Boundary Channel Dr.
28. Other
29. Don't know
30. I do not use I-95/I-395

10. In addition to I-95/I-395, what other major highways, if any, do you typically travel on your regular morning commute?

    1. I-495/Capital Beltway traveling towards Tysons
    2. I-495/Capital Beltway traveling towards Alexandria
    3. I-66
    4. Dulles Toll Road (DTR)
    5. Fairfax County Parkway/Franconia-Springfield Parkway
    6. George Washington Parkway
    7. Prince William Parkway
    8. US Route 1
    9. VA Route 3
    10. VA Route 7
    11. US Route 17
    12. VA Route 28
    13. US Route 29
    14. US Route 50
    15. VA Route 123
    16. VA Route 234
    17. None of these

11. How long have you been commuting using the transportation mode(s) you now use?

    1. Less than one year
    2. 1-2 years
    3. 3-5 years
    4. 6-9 years
    5. 10-15 years
    6. Over 15 years

12. In the past, which of the following transportation mode(s) other than driving alone have you ever used on a regular basis, regardless of where you may have been living? Please select all that apply.

1. Travel in a pre-arranged carpool with 1 other person either as the driver or as a passenger
2. Travel in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger
3. Travel in an informal carpool (slugging) where you are the person who **gets picked up** as a passenger
4. Travel in an informal carpool (slugging) where you are the person who **picks up** passengers
5. Travel in a vanpool either as the driver or as a passenger
6. Ride a bus
7. Ride a train (VRE, Metrorail, or Amtrak)
8. Telework/telecommute
9. Walk
10. Ride a bike
11. Other
12. None of these

13. What is the zip code of the usual location where your morning commute begins (for example, your home zip code)? *Your information is confidential, and we are not going to contact you there.* We just want to know the general location of your usual trip start so we can analyze transportation corridor improvements.

Zip code: ___ ___ ___ ___ ___

☐ Don't know/can't recall zip code

14. What is the general location of the start of your morning commute (for example, your home)?

1. Alexandria
2. Arlington
3. Caroline County, South of Massaponax
4. Dale City
5. Dumfries/Triangle
6. Fredericksburg
7. Falmouth
8. Ft. Belvoir
9. Garrisonville
10. Kingstowne
11. Lake Ridge
12. Lorton
13. Manassas
14. Montclair
15. Occoquan
16. Quantico
17. Spotsylvania
18. Springfield
19. Stafford
20. Woodbridge
21. Other location in Fairfax County
22. Other location in Prince William County
23. Other location in Spotsylvania County
24. Other location Stafford County
25. Some other location

**(IF ANSWERED "21-25" AT Q14, ASK 14a.)**

14a.What location is that? _____

15. What is the zip code of your usual destination (for example, your workplace) on your morning commute? *Your information is confidential, and we are not going to contact you there.* We just want to know the general location of your usual destination so we can analyze transportation corridor improvements.

Zip code: ___ ___ ___ ___ ___

☐ Don't know/can't recall zip code

16. What is the general location of your usual destination (for example, your workplace) on your morning commute?

1. Alexandria
2. Annandale
3. Arlington
4. Baileys Crossroads
5. Ballston
6. Chantilly area
7. Crystal City
8. Dale City area
9. Dumfries area
10. Fairfax City
11. Falls Church
12. Herndon/Reston
13. Leesburg
14. Loudoun County
15. Manassas
16. Manassas Park
17. Maryland
18. McLean
19. Merrifield
20. Pentagon
21. Springfield
22. Tysons
23. Vienna

24. Washington, DC
25. Western Dulles Corridor
26. Woodbridge
27. Some other location

**(IF ANSWERED "27" AT Q16, ASK Q16a.)**

16a. What location would that be? _____

17. On average, about how many **minutes** long is your total morning commute, door to door?

1. 10 minutes or less
2. 11-20 minutes
3. 21-30 minutes
4. 31-40 minutes
5. 41-50 minutes
6. 51-60 minutes
7. 61-70 minutes
8. 71-80 minutes
9. 81-90 minutes
10. 91-100 minutes
11. 101-110 minutes
12. 111-120 minutes
13. More than 120 minutes
14. Don't know

18. About how many **miles** long is your total morning commute, door to door?

_____ miles

19. Again, please think of your travel in the I-95/I-395 corridor during a typical week, Monday through Friday. Do you typically use the same mode of transportation for your **afternoon** commute as you do for your **morning** commute?

1. Yes, typically my mode of transportation in the afternoon is the same as in the morning → **SKIP TO Q23**
2. No, typically my mode of transportation in the afternoon is not the same as in the morning

20. In the table below, please enter the number of weekdays you typically use each of the listed types of transportation as your **primary** mode of transportation for your **afternoon return** trip. If you use more than one type on a single day (e.g., walk to the bus stop, then ride the bus), please count only the type you use for the longest distance part of your trip. (If you do not use a particular form of transportation for your afaternoon commute, please enter a 0 for that form of transportation.)

| Type of Transportation | Number of Days Used (Enter 0 to 5) |
|---|---|
| 1. Drive alone | |
| 2. Travel in a pre-arranged carpool with 1 other person either as the driver or as a passenger | |
| 3. Travel in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger | |
| 4. Travel in an informal carpool ("slugging" - picking up or picked up passengers to use the HOV lanes) | |
| 5. Travel in a vanpool as either the driver or as a passenger | |
| 6. Ride a bus | |
| 7. Take Metrorail | |
| 8. Take Virginia Railway Express (VRE) | |
| 9. Other _____ | |
| TOTAL WEEKDAYS | (SUM OF 1-9) |

**(IF CHOICE "6" IS GREAT THAN 0 AT Q20, ASK Q21. OTHERS SKIP TO Q23.)**



DRPT
Virginia Department of Rail and Public Transportation
The Smartest Distance Between Two Points

21. What bus line would that be?

1. ART (Arlington Transit)
2. CUE (City of Fairfax)
3. DASH (Alexandria Transit Co.)
4. Fairfax Connector
5. FRED
6. GEORGE (City of Falls Church)
7. Loudoun County Transit Service
8. Martz
9. Metrobus/WMATA
10. PRTC/OmniLink/OmniRide/OmniBus
11. Quick's
12. TAGS Bus
13. Other

**(IF ANSWERED "13" AT Q21, ASK Q22. OTHERS SKIP TO Q23.)**

22. What bus line is that?

_____

_____

*II. REASONS FOR USING CURRENT TRANSPORTATION MODE*

23. Next, think about what factors are important to you when deciding how you will commute. How important to you are the following factors in choosing how you commute on your **morning** commute trip? For your answer, please use a scale of "1" to "5" where "1" means it is "not at all important" and "5" means it is "very important" in choosing your mode of transportation. How important to you is each of the following?

| | **Not at all Important** | | | | **Very Important** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**ASK EACH RESPONDENT HALF OF THE FOLLOWING LIST (ROTATE):**

a. The time you have to leave home in the morning
b. The length of time it takes to commute
c. Cost of fares
d. Cost of tolls
e. Price of gas
f. Comfort
g. Flexibility
h. Dependability
i. Safety
j. Making productive use of your time during the commute
k. Time alone to yourself
l. Being in control of your commute
m. Reducing your level of stress
n. Availability of transportation if you have to be at work/school late or have to leave work/school unexpectedly
o. Availability of transportation during the day while you are at work/school
p. Arriving at work/school on time

q. Availability of parking at work/school site
r. Cost of parking at work/school site
s. Availability of HOV lanes
t. Ability to find a carpool or slugging partner

**Ask carpoolers (choice "2," "3," or "4" at Q6):**

How important were each of the following in your decision to carpool?

u. Availability of slug lines / informal carpool pick-up points
v. Availability of "free" or preferential parking for carpools at work/school
w. Availability of parking at carpool "connecting" or "pick-up" point

**Ask vanpoolers (choice "5" at Q6):**

How important were each of the following in your decision to vanpool?

x. Availability of "free" or preferential parking for vanpools at work/school
y. Availability of parking at vanpool "connecting" or "pick-up" point
z. Employer provided transportation subsidy (e.g., Metrochek)

**Ask bus riders (answer "6" at Q6):**

How important were each of the following in your decision to ride the bus?

aa. Availability of bus at time you want to travel
bb. Cost of parking at "connecting" or "pick-up" point
cc. Availability of parking at "connecting" or "pick-up" point
dd. Employer provided transportation subsidy (e.g., Metrochek)

**Ask train riders (answer "7" or "8" at Q6):**

How important were each of the following in your decision to ride the train?

ee. Availability of train at time you want to travel
ff. Cost of parking at "connecting" or "pick-up" point
gg. Availability of parking at "connecting" or "pick-up" point
hh. Employer provided transportation subsidy (e.g., Metrochek)

24. Is there any other factor that is important to you when selecting your **morning** commute mode?

1. Yes → **GO ON TO Q25**
2. No → **SKIP TO Q27**

25. What other factor is important in your commute choice?

_____

**IF ONE LISTED, ASK:**

26. How important is that in your choice of how you will commute?

| | **Not at all Important** | | | | **Very Important** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED "2" AT Q19, ASK Q27. OTHERS SKIP TO Q28.)**

27. Earlier, you indicated that you use different commute mode(s) in the afternoons than you do in the mornings. Why do you use different commute mode(s) in the afternoon?

_____

_____

*III. CURRENT USE OF HOV LANES*

28. Prior to this survey, were you aware of the High-Occupancy Vehicle (HOV) lanes on I-95/I-395?

1. Yes
2. No → **SKIP TO Q36**
9. Don't know → **SKIP TO Q36**

29. How familiar are you with the HOV lanes on I-95/I-395? By familiar we mean, do you know where the exits and entrances for the HOV lanes are? Do you know the basic hours of operation? How familiar would you say you are with the HOV lanes? Please use a scale of 1-5 for your answer where "1" is "not very familiar" and "5" is "very familiar."

| | **Not very Familiar** | | | | **Very Familiar** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

30. Is there an entrance to the HOV lanes that you currently use or could use on your morning commute?

1. Yes
2. No → **SKIP TO Q33**
9. Don't know → **SKIP TO Q33**

31. Please select the entrance to the HOV lanes that you currently use or could use on your morning commute.

1. South of VA Route 234 (Dumfries)
2. South of Dale Blvd / Rest Area
3. South of Prince William Parkway
4. Horner Road Park and Ride Lot
5. VA Route 123 (Gordon Blvd)
6. US Route 1
7. South of Fairfax County Parkway
8. Franconia - Springfield Parkway
9. Old Keene Mill Road / Franconia Road
10. North of Edsall Road
11. Seminary Road
12. Shirlington Road / Quaker Lane
13. Eads Street / Pentagon
14. Ramp at 14th St. Bridge
15. None of these / Don't know

32. How frequently during your weekday morning commute do you use the HOV lanes on I-95/I-395, either driving alone in your vehicle or traveling in a carpool, vanpool, or bus?

1. occasionally - less than once a week
2. 1-2 days a week
3. 3 days a week
4. 4 days a week
5. 5 days a week
6. None
9. Don't know

**(IF "2," "3," "4," OR "5" AT Q32, SKIP TO Q34. IF ANSWERS "1" OR "6" AT Q32, ASK Q33. IF "9" AT Q32, SKIP TO Q37.)**

33. If there were an HOV entrance conveniently accessible on your morning commute and you were to use the HOV lanes, what form of transportation would you be most likely to use? Assume that parking would be available at your "pick-up" or "connection" location.

1. Travel in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger
2. Travel in an informal carpool (slugging) where you are the person who **gets picked up** as a passenger
3. Travel in an informal carpool (slugging) where you are the person who **picks up** passengers
4. Travel in a vanpool either as the driver or as a passenger
5. Ride a bus
6. Ride a train (VRE, Metrorail, or Amtrak)
7. Telework/telecommute
8. Walk
9. Ride a bike
10. Other

**(IF "1," "2," "3," "4," OR "5" AT Q32, ASK Q34. OTHERS SKIP TO Q36.)**

34. Please select the time that most closely corresponds to the time you currently enter (or would enter) the HOV lanes on a typical morning.

1. Prior to 5:00 a.m.
2. 5:00-5:30 a.m.
3. 5:31-6:00 a.m.
4. 6:01-6:30 a.m.
5. 6:31-7:00 a.m.
6. 7:01-7:30 a.m.
7. 7:31-8:00 a.m.
8. 8:01-8:30 a.m.
9. 8:31-9:00 a.m.
10. After 9:00 a.m.

**NO Q35**

*IV. AWARENESS OF AND FAMILIARITY WITH HOT LANES*

**NO Q36**

37. Have you ever heard or read anything about the proposed construction of the High Occupancy Toll (HOT) lanes in the I-95/I-395 corridor?

1. Yes
2. No
9. Don't know/not certain

37A. Here's some information about proposed HOT lanes in the I-95/I-395 corridor: HOT lanes may be constructed on I-95/I-395. Construction could begin in 2008. The project would expand the existing High Occupancy Vehicle (HOV) facility on I-95/I-395 from two to three lanes and extend two new lanes south of Fredericksburg to Massaponax. All of these lanes would become High Occupancy Toll (HOT) lanes – meaning that buses, vanpools, motorcycles, and carpools with three or more people could continue to use the lanes for free, and non-HOV motorists could choose to pay a toll to use the lanes. Drivers of hybrid vehicles would not be able to use the lanes for free unless they met the same carpool occupancy requirements as non-hybrid vehicles.

The HOT lanes would be in effect 24 hours a day, but their direction would change to match peak period travel just as the existing HOV lanes do today. So, the HOT lanes would be northbound during some periods of time (e.g., morning) and southbound during other periods of time (e.g., evening) to correspond with peak travel. HOT lanes are also proposed for I-495, the Capital Beltway. The HOT lanes on I-95/I-395 would connect to the HOT lanes on I-495 from Springfield to Tysons Corner. The following questions relate to the HOT lanes being proposed for the I-95/I-395 corridor.

38. Next is a list of statements about the HOT lanes. Please indicate the extent to which you agree or disagree with each statement. Use a scale of 1-5 for your answer where "1" means that you "**dis**agree strongly" with the statement and "5" means that you "**agree** strongly" with the statement.

| | **Disagree Strongly** | | | | **Agree Strongly** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(ROTATE)**

**(ASK EACH RESPONDENT HALF OF LIST.)**

a. HOT lanes will help traffic to flow faster in the general purpose lanes on I-95/I-395
b. HOT lanes will help traffic to flow faster in the existing HOV lanes
c. HOT lanes will create new transit, vanpooling, and carpooling opportunities
d. HOT lanes will help commuters save time on their commutes
e. HOT lanes will benefit all commuters, even those that do not use them
f. The disruption caused by the construction of HOT lanes will be worse than any eventual benefit
g. HOT lanes will encourage drivers to pick up sluggers in order to avoid paying the toll to use the HOT lanes
h. HOT lanes will discourage drivers from picking up sluggers – drivers will simply pay the toll to use the HOT lanes
i. HOT lanes will play a key role in the region's emergency and evacuation plans
j. HOT lanes will benefit the environment because there will be fewer vehicles on the road and, thus, reduced vehicle emissions
k. HOT lanes will help I-95/I-395 to support the region's economic vitality
l. HOT lanes will add too much growth and development to the area
m. HOT lanes will help commuters be able to spend less time commuting and more time doing things they enjoy

*V. FUTURE COMMUTE BEHAVIOR AND USE OF HOT LANES*

39. Assume the HOT lanes are completed and open for use. How likely would you be to use them at least occasionally for your regular commute? Use a scale of "1" to "5" for your answer, where "1" means that you are "not at all likely" to use this alternative and "5" means you are "very likely."

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED "4" OR "5" AT Q39, ASK Q40. OTHERS SKIP TO Q41.)**

40. How often would you use the HOT lanes during the week, Monday through Friday?

1. occasionally - less than once per week
2. 1-2 days a week
3. 3 days a week
4. 4 days a week
5. 5 days a week
6. It would vary
9. Don't know

**(IF Q6 DRIVE ALONE > 6, ASK Q41-A.)**

41-A. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use? Please select only one answer.

1. I would **continue to drive alone** in my own vehicle and pay to use the HOT lanes.
2. I would **stop driving alone** in my own vehicle and switch to a form of transportation that allows me to use the HOT lanes without paying (e.g., carpool, vanpool, slugging, or transit).
3. I would **stop driving alone** in my own vehicle and switch to a carpool with one other person to allow me to split the HOT lane toll with that person.
4. I would **not change** the way I commute in any way.
5. I would do something not listed here.

**(IF ANSWERED "4" AT Q41, ASK Q42. OTHERS SKIP TO Q43.)**

**(IF Q6, DRIVE ALONE = 0, ASK Q41-B.)**

41-B. Which of the following statements best describes how you would typically commute when the HOT lanes are completed and open for use? Please select only one answer.

1. I would **start driving alone** in my own vehicle and pay to use the HOT lanes.
2. I would **start driving alone** in my own vehicle, but I would not use the HOT lanes. I would drive in the regular lanes.
3. I would **not change** the way I commute in any way.
4. I would do something not listed here.

**(IF ANSWERED "5" AT Q41-A OR "4" AT Q41-B, ASK Q41-C.)**

41-C. What, specifically, would you do?

_____

42. If you were to change to another form of transportation to use the HOT lanes for free, what would you **most likely** use?

1. Travel in a pre-arranged carpool with 2 or more other people as either the driver or as a passenger
2. Travel in an informal carpool (slugging) where you are the person who **gets picked** up as a passenger
3. Travel in an informal carpool (slugging) where you are the person who **picks up passengers**
4. Travel in a vanpool either as the driver or as a passenger
5. Ride a bus
6. Take Virginia Railway Express (VRE)
7. Take Metrorail
8. Telework/telecommute
9. Other

**(IF ANSWERED "1," or "2" AT Q17 [COMMUTE IS 20 MINUTES OR LESS], SKIP TO Q46. OTHERS, PROVIDE INFORMATION AT Q43 AND ASK Q44.)**

43. Now, we'd like to share some additional information with you about the proposed HOT lanes. The HOT lanes would be tolled 24-hours a day, seven days a week. The cost of the tolls to use the HOT lanes would vary throughout the day according to traffic conditions to maintain free-flowing conditions on the HOT lanes. That is, tolls would be higher when the demand for the lanes is greater, such as during rush hour. When demand for the lanes is lighter, tolls would be less. In addition, new access and exit points would be constructed to allow drivers to be able to enter and exit the HOT lanes at various points on their commutes. Drivers of hybrid vehicles would pay the same toll as other vehicles. Drivers of hybrid vehicles would not be able to use the HOT lanes without paying the toll**. PLEASE DO NOT GO BACK AND CHANGE YOUR PREVIOUS ANSWERS ABOUT USING THE HOT LANES.**

**WE WILL GIVE YOU THE OPPORTUNITY TO RESPOND AGAIN ABOUT USING THE HOT LANES.**

44. Suppose that by using the HOT lanes on your typical commute, you could reliably shorten the duration of your commute. Again, you could choose to use only a segment of the HOT lanes between an entry point and new exit point. How do you think you would respond at various levels of time savings and toll cost?

We will now describe several different combinations of time savings and toll prices. We'd like to know how you would respond to each

**(PRESENT 3 OR 4 SCENARIOS BASED ON RESPONSE TO Q17 AND Q6 AS SHOWN BELOW.)**

Assume that by using the HOT lanes, you could typically shorten the length of your commute versus what you do today by **(INSERT TIME SAVINGS FROM LIST BELOW)** minutes and the one-way cost of the toll is typically **(INSERT COST FROM LIST BELOW)**. Which of the following best describes what you would do?

**(PROGRAMMER INSTRUCTIONS: DO NOT BOLD OR CAPITALIZE INSERTIONS.)**

44-1. **(IF Q6 DRIVE ALONE IS > 0:)**

1. I would **continue to drive alone** in my own vehicle and **pay** to use the HOT lanes.
2. I would **stop driving alone** in my own vehicle and switch to a form of transportation that allowed me to use the HOT lanes without paying (e.g., carpool, vanpool, slugging, or transit).
3. I would **stop driving alone** in my own vehicle and switch to a carpool with one other person to allow me to split the HOT lane toll with that person.
4. I would **not change** the way I commute in any way.
5. I would do something not listed here.

44-2. **(IF Q6 DRIVE ALONE = 0:)**

1. I would **start driving alone** in my own vehicle and **pay** to use the HOT lanes.
2. I would **start driving alone** in my own vehicle, but I would not use the HOT lanes. I would drive in the regular lanes.
3. I would **not change** the way I commute in any way.
4. I would do something not listed here.

**(IF ANSWERED "2" AT Q44-1, ASK Q44A.)**

44A. What, specifically, would you do?

1. Travel in a pre-arranged carpool with 2 or more other people either as the driver or as a passenger.
2. Travel in an informal carpool (slugging) where you are the person who **gets picked up** as a passenger
3. Travel in an informal carpool (slugging) where you are the person who **picks up** passengers
3. Travel in a vanpool either as the driver or as a passenger.
4. Ride a bus
5. Ride a train (VRE, Metrorail, Amtrak)
6. Other

**(IF ANSWRED "5" AT Q44-1 OR "4" AT Q44-2, ASK Q44B.)**

44B. What, specifically, would you do?

_____

_____

45. **(FOR SCENARIO QUESTIONS BELOW, IF ANSWER TO Q6, CHOICE "1" >2 [SOV], THEN ASK ALL FOUR SCENARIOS. OTHERWISE, ONLY PRESENT FIRST THREE.)**

(The pre-determined element in each scenario is the number of minutes of savings; toll amount presented will be computed as a random number between $0.10 and $0.50 per minute of savings rounded to nearest $0.25 (i.e., if RAND = 0.12/min and Savings = 8 min., toll = $1.00.) The order that the three/four scenarios are presented should be random.)

**IF ANSWER TO Q17 IS:**

**"3" - 21-30 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 5 minutes | $0.50 - $2.50 |
| 8 minutes | $0.75 - $4.00 |
| 10 minutes | $1.00 - $5.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 12 minutes | $1.25 - $6.00 |

**IF ANSWER TO Q17 IS:**

**"4" - 31-40 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 5 minutes | $0.50 - $2.50 |
| 10 minutes | $1.00 - $5.00 |
| 12 minutes | $1.25 - $6.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 15 minutes | $1.50 - $7.50 |

**IF ANSWER TO Q17 IS:**

**"5" – 41 - 50 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 5 minutes | $0.50 - $2.50 |
| 10 minutes | $1.00 - $5.00 |
| 15 minutes | $1.50 - $7.50 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 20 minutes | $2.00 - $10.00 |

**IF ANSWER TO Q17 IS:**

**"6" – 51 - 60 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 5 minutes | $0.50 - $2.50 |
| 10 minutes | $1.00 - $5.00 |
| 15 minutes | $1.50 - $7.50 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 20 minutes | $2.50 - $10.00 |

**IF ANSWER TO Q17 IS:**

**"7" – 61 - 70 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 10 minutes | $1.00 - $5.00 |
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 25 minutes | $2.50 - $12.50 |

**IF ANSWER TO Q17 IS:**

**"8" – 71 - 80 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 10 minutes | $1.00 - $5.00 |
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 30 minutes | $3.00 - $15.00 |

**IF ANSWER TO Q17 IS:**

**"9" – 81 - 90 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 10 minutes | $1.00 - $5.00 |
| 15 minutes | $2.00 - $7.50 |
| 25 minutes | $2.50 - $12.50 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 35 minutes | $3.50 - $17.50 |

**IF ANSWER TO Q17 IS:**

**"10" – 91 - 100 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| 30 minutes | $3.00 - $15.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 40 minutes | $4.00 - $20.00 |

**IF ANSWER TO Q17 IS:**

**"11" – 101-110 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| 30 minutes | $3.00 - $15.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 40 minutes | $4.00 - $20.00 |

**IF ANSWER TO Q17 IS:**

**"12" – 111-120 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| 30 minutes | $3.00 - $15.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 45 minutes | $4.50 - $22.50 |

**IF ANSWER TO Q17 IS:**

**"13" – MORE THAN 120 MINUTES**

| Time savings | Cost of toll |
|---|---|
| 15 minutes | $1.50 - $7.50 |
| 20 minutes | $2.00 - $10.00 |
| 30 minutes | $3.00 - $15.00 |
| **IF ANSWER TO Q6, CHOICE "1" >2, ASK 4TH SCENARIO. OTHERS SKIP LAST SCENARIO** | |
| 50 minutes | $5.00 - $25.00 |

*VI. TRANSIT-RELATED SERVICE IMPROVEMENTS*

As a result of HOT lanes, some transit-related service improvements will be put in place. Next, we have some questions about transit services.

[EXPRESS BUS QUESTIONS]

46. Is there express bus service reasonably available for the area where you commute? An express bus service is a motorcoach or bus, generally traveling longer distance with limited stops, taking commuters to their work areas.

1. Yes→ **GO TO Q47**
2. No → **SKIP TO Q48**
9. Don't know→ **SKIP TO Q48**

47. How often do you use that express bus service?

1. occasionally – less than once a week
2. 1-2 days a week
3. 3 days a week
4. 4 days a week
5. 5 or more days a week
6. Never, I do not ride the express bus → **SKIP TO Q48**
9. Don't know → **SKIP TO Q48**

47A. Next is a list of potential improvements to that express bus service. Please indicate how important each improvement would be to you in helping you choose to continue riding express bus service or to increase your usage. Use a scale of 1-5 for your answer where "1" means "**not at all important**" and "5" means "**very important**".

| | **Not at all Important** | | | | **Very Important** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(ROTATE – ASK EACH ELIGIBLE RESPONDENT HALF OF LIST.)**

a. Earlier morning inbound service
b. More midday inbound service
c. Earlier afternoon outbound service
d. Later evening outbound service
e. More frequent service
f. More parking spaces at the existing park-and-ride lot
g. New park-and-ride lot more convenient to my home
h. Shuttle bus service from your neighborhood to the bus pick-up point
i. Shuttle bus service from your bus drop-off point to your final destination
j. Bicycle racks at the park-and-ride lot
k. Bicycle racks on buses
j. Provision of information about whether your bus is on time, available on cell phone or by email

47B. What other very important improvement or improvements, if any, could be made to help keep you riding or increase your riding of the express bus?

_____

**(SKIP TO Q55)**

48. If new express bus service were available for the area where you commute (e.g., where you live to where you work), how likely would you be to use it at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

49. If the schedule were revised so that express buses came more often, how likely would you be to ride an express bus at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

50. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to an express bus stop. How likely would you be to ride an express bus at least 1-2 days a week if such a feeder bus service operated?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

51. Suppose that a shuttle bus service could operate frequently in the morning and afternoon peak hours between the express bus drop-off point and your commute destination. How likely would you be to ride an express bus at least 1-2 days a week if such a shuttle bus service operated?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

52. Is there a park-and-ride lot located along your commute where you could catch an express bus?

1. Yes → **SKIP TO Q55**
2. Yes, but the lot is usually full → **SKIP TO Q55**
2. No → **GO ON TO Q53**
9. Don't know → **GO ON TO Q53**

53. If there were a new park-and-ride lot located along your commute, how likely would you be to use it at least 1-2 days a week in order to take an express bus?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERD "4" OR "5" AT Q53, ASK Q54. OTHERS SKIP TO Q55.)**

54. Where, specifically, would be the best place for that park-and-ride lot?

_____

**(IF ANSWER "8" AT Q6 > 0 [USES VRE], ASK Q55A. ALL OTHERS ASK Q55B.)**

55-A. Earlier you indicated that you use the VRE service. Following is a list of potential improvements to that service. Please indicate how important each improvement would be to you in helping you choose to continue riding VRE or to increase your usage. Use a scale of 1-5 for your answer where "1" means "**not at all important**" and "5" means "**very important**."

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(ROTATE – ASK EACH ELIGIBLE RESPONDENT HALF OF LIST.)**

a. Earlier morning inbound service
b. More midday inbound service
c. Earlier afternoon outbound service
d. Later evening outbound service
e. More frequent service
f. More parking spaces at the existing station parking lot
g. New station more convenient to my home
h. Shuttle bus service from my neighborhood to the closest station
i. Shuttle bus service from my current exit station to my final destination
j. Bicycle racks at the station
k. Improved bicycle accommodations on trains
l. Provision of information about whether my train is on time available on cell phone or by email

55-A-2. What other very important improvement could be made to help keep you riding or increase your riding of VRE?

_____

**(SKIP TO INSTRUCTIONS BEFORE Q56.)**

55-B. Is Virginia Railway Express (VRE) conveniently available for at least a portion of your commute?

1. Yes → **SKIP TO Q57**
2. No
9. Don't know

**(IF LIVE IN ZIP CODES SOUTH OF FREDERICKSBURG, ASK Q56. OTHERS SKIP TO INSTRUCTIONS BEFORE Q57.)**

56. If a VRE station were constructed south of Fredericksburg, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED 0 for VRE on Q6 ASK Q57 and Q58. ALL OTHERS ASK Q59.)**

57. If additional VRE trains were added so that they came more often, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

58. If VRE trains had more seats available, how likely would you be to use the Virginia Railway Express for your commute at least 1-2 days a week?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED =0 for VRE on Q6 ASK Q60. ALL OTHERS ASK Q59.)**

59. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to take this shuttle bus?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ASKED Q59, SKIP TO Q61.)**

60. Suppose a shuttle bus service could operate frequently in the morning and afternoon peak hours between the VRE train station and your commute destination (e.g., work). How likely would you be to ride VRE if this shuttle bus service were offered?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED >0 for VRE on Q6 ASK Q62. ALL OTHERS ASK Q61.)**

61. Suppose a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the VRE train station. How likely would you be to use this feeder bus?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(ALL WHO WERE ASKED Q61, SKIP TO Q64.)**

62. Suppose a shuttle feeder bus could operate frequently in your neighborhood that would circulate and connect to the VRE train station. How likely would you be to use this feeder bus and take VRE at least 1-2 days a week?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

63. If more parking were available at VRE train stations, how likely would you be to take VRE at least 1-2 days a week?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED >0 FOR METRORAIL AT Q6 AND/OR Q20, DO NOT ASK Q64.)**

64. Is Metrorail available for at least a portion of your commute?

1. Yes → **SKIP TO INSTRUCTIONS BEFORE Q66**
2. No
9. Don't know

**(IF ANSWERED "2" OR "9" AT Q64 AND LIVE IN ZIP CODES 22194, 22191, 22195, 22192, OR 22193, ASK Q65. OTHERS WHO ANSWERED "2" OR "9" AT Q64 SKIP TO INSTRUCTIONS BEFORE Q66.)**

65. If a Metrorail station were constructed near Potomac Mills, how likely would you be to take Metrorail at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED =0 for Metrorail on Q6 ASK Q66 and Q67. ALL OTHERS ASK Q68.)**

66. If the schedule were revised so that trains came more often, how likely would you be to use Metrorail for your commute at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

67. If trains were less crowded, how likely would you be to use Metrorail for your commute at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED =0 FOR Metrorail AT Q6, ASK Q69. ALL OTHERS ASK Q68.)**

68. Suppose that a shuttle bus service between the **Metrorail** train station and your place of work could operate frequently in morning and afternoon peak hours. How likely would you be to use this shuttle bus service?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

69. Suppose that a shuttle bus service between the Metrorail train station and your commute destination (e.g., work) could operate frequently in morning and afternoon peak hours. How likely would you be to ride Metrorail if this shuttle bus service were offered?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED =0 for Metrorail at Q6, ASK Q71. ALL OTHERS ASK Q70.)**

70. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the **Metrorail** station. How likely would you be to ride this feeder bus if it operated in your neighborhood?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

71. Suppose that a shuttle bus could operate frequently in your neighborhood that would circulate and connect to the Metrorail station. How likely would you be to ride Metrorail at least 1-2 days a week if a feeder bus operated in your neighborhood?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF Metrorail = 0 at Q6, ASK Q72. OTHERS SKIP TO Q73.)**

72. If more parking were available at Metrorail stations, how likely would you be to take Metrorail at least 1-2 days a week?

| | Not at all Likely | | | | Very Likely | (Don't Know) |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF Q6 is 1 only – 100% SOV drive alone only - ASK Q73. OTHERS SKIP TO Q78.)**

73. Is there a place such as a park-and-ride lot conveniently located on your commute where you could ever catch a carpool or vanpool or commuter bus?

1. Yes → **SKIP TO Q77**
2. No
9. Don't know

74. If a park-and-ride lot were conveniently located, how likely would you be to use it at least 1-2 days a week in order to use a form of transportation other than driving alone?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

75. Suppose that HOT lanes are built and a park-and-ride lot was located convenient for your commute. How likely would you be to use the park-and-ride lot to take advantage of free travel on the HOT lanes in a bus, vanpool, or three-person carpool?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**(IF ANSWERED "4" OR "5" AT Q75, ASK Q76. OTHERS SKIP TO Q77.)**

76. Where, specifically, would be the best place for that park-and-ride lot?

_____

77. Suppose you could pay to have a reserved parking space at a convenient park-and-ride lot. The cost of parking would be up to $5.00 per day and would be paid on a monthly basis. How likely would you be to pay for a reserved parking space at a park-and-ride lot in order to travel in a bus, vanpool, or three-person carpool and use the HOT lanes for no additional charge at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

78. Suppose that Bus Rapid Transit (BRT) service became available in the general area of your commute. BRT offers frequent express service in comfortable vehicles serving station-like stops. How likely would you be to use this bus service for your commute at least 1-2 days a week?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

79. Suppose you could use a self-assisted, online ride-matching service to find a rideshare partner in order to use the HOT lanes. This service provides you with a list of commuters who live in your area, commute to the same area as you do and are also looking for a vanpool or carpool partner. You register for this service online and receive the information online. How likely would you be to use this type of ride-matching service if you wanted to carpool or vanpool and use the HOT lanes?

| | **Not at all Likely** | | | | **Very Likely** | **(Don't Know)** |
|---|---|---|---|---|---|---|
| Scale: | 1 | 2 | 3 | 4 | 5 | 9 |

**[SKIP Q80-81 IF RESPONDENT ANSWERED "2" FOR Q3 (i.e., "school")]**

80. Which of the following does your employer offer?

| | Yes | No | Don't know |
|---|---|---|---|
| a. Free or subsidized parking | 1 | 2 | 3 |
| b. Preferred parking spaces for carpools/vanpools | 1 | 2 | 3 |
| c. Transit fare subsidies/benefits, Metrochek or SmartBenefits | 1 | 2 | 3 |
| d. Vanpool/carpool ridematching program/assistance | 1 | 2 | 3 |
| e. Flexible work hours | 1 | 2 | 3 |
| f. Compressed work week | 1 | 2 | 3 |
| g. Telework or telecommute | 1 | 2 | 3 |
| h. Shuttle to Metrorail station | 1 | 2 | 3 |
| i. Guaranteed Ride Home program | 1 | 2 | 3 |
| j. Another program or programs | 1 | 2 | 3 |

If yes: What is that program or programs? _____

81. Is there ample parking at your worksite?

1. Yes
2. No
9. Don't know

**NO Q82-83**

84A. How many licensed drivers are there in your household?

_____

84B How many total vehicles are there in your household that are available to use for the commute – including your commute and the commutes of all other adults in your household?

_____

*VII. DEMOGRAPHICS*

Our final questions are for classification purposes only.

85. Which of the following best describes your employer?

1. The military
2. Federal government
3. State or local government
4. Private company
5. Self-employed
6. I am a full-time student
7. Other

86. Do you have school-aged children in your household?

1. Yes
2. No
9. Don't know/prefer not to say

87. Which of the following represents your total combined annual household income?

1. Less than $15,000
2. $15,000-$24,999
3. $25,000-$34,999
4. $35,000-$49,999
5. $50,000-$74,999
6. $75,000-$99,999
7. $100,000-$124,999
8. $125,000 - $149,999
9. $150,000 or higher
10. Don't know/prefer not to say

88.Please indicate your gender.

1. Male
2. Female

89. Would you be interested in participating in future focus groups, telephone interviews, or Internet surveys regarding traffic and transportation issues in your area?

1. Yes
2 No
9. Don't Know

90.**(IF "YES" AT Q89, ASK:)** Great! May we have an **email address** along with **your first name** and/or **telephone number** to easily contact you for participation in future focus groups or surveys? We will not give or sell the email or telephone number to any one. It will be strictly used for this panel of motorists who want to be involved with transportation and planning issues in the I-95/I-395 corridor.

First Name:_____

Email address: _____

Telephone number: _____

91.Thank you for completing this survey. In order for us to mail your $5.00 Starbucks' gift card to you, we need to know:

Your name: _____
Your street address: _____
City: _____
Zip code: _____

**(Note: Include option: I don't wish to receive a Starbucks' gift card.)**

For more information about this study, please feel free to visit our project Web site:
http://www.drpt.virginia.gov/projects/TransitTDMStudy.aspx

**Thank you for participating in this important research! Your Opinion Counts.**

# Thank You!

For additional information on
this report,
please contact
Dr. Karen Smith
Southeastern Institute of Research
804-358-8981



DRPT
Virginia Department of Rail and Public Transportation
The Smartest Distance Between Two Points

# Appendix D

# Appendix D – Travel Demand Forecasts – Supplemental Information

## *D.1 Regional Forecasting Tool Details*

The MWCOG travel demand forecast model uses a series of submodels or steps to forecast potential travel demand given the future land use and transportation networks. The regional transportation options are represented in terms of a network. The network represents all of the transportation services and infrastructure. This network includes transit and highway facilities. The Washington metropolitan area is divided into 2,191 traffic analysis zones (TAZ). In the denser populated areas, there are a greater number of TAZs and in less dense areas the TAZs are larger. At the boundaries of the modeled areas the TAZs are larger and the highway network is less detailed. In the primary modeled jurisdictions, the highway network is more detailed and the corresponding number of TAZs is greater.

### D.1.1 Trip Generation

The MWCOG model is a four-step model. The trip generation step answers the question of how much travel and for what purpose. That is, the trip generation model produces trips by purpose by TAZ. The output from the trip generation model is the number of productions and attractions by purpose at the origin TAZ or destination TAZ, as appropriate. In the MWCOG model process, there are four primary trip purposes modeled:

- **Home-Based Work (HBW) –** Home-based work trips originate at home and travel to a place of work and back again;
- **Home-Based Shop (HBS) –** Home-based shopping trips originate at home and travel to a place of shopping and return home again;
- **Home-Based Other (HBO) –** Home-based other trips include all trips from a home not associated with work or shopping; and
- **Nonhome-Based (NHB) –** Nonhome-based trips are trips that do not originate or end at a home. These can include trips from the place of work which return to the place of work or other similar types of trips.

### D.1.2 Trip Distribution

The second step in the process is trip distribution. The trip distribution step answers the question where do trips travel. The trip distribution model determines the origin and destination of the productions and attractions from the trip generation step. The trip distribution model looks at the distribution of trips based on travel time and applies that to match productions and attractions. As future congestion increases, the trip length tends to decrease, while the travel-time distribution tends to remain constant. The end product of the distribution model is a single motorized person trip table for each trip purpose giving the total trips made between each origin and destination TAZ pair.

### D.1.3 Mode Choice

The third step in the process is the mode choice model. This step answers the question of how travel will be done. The mode choice model produces the probability of a specific mode choice for a specific origin-destination pair. The model determines this probability based on elements such as in-vehicle travel time, out of vehicle wait time, the number of transfers, and other relevant choice criteria. The end product of the model choice model is a set of trip tables giving trips made between each origin and destination TAZ pair by mode.

### D.1.4 Trip Assignment

The fourth step in the process is the assignment. The assignment step answers the question of what route a trip will travel given an origin and destination TAZ. There are two assignments – a highway assignment and a transit assignment. The highway assignment captures vehicle trips on the network, while the transit assignment captures person trips on transit modes through the network. The networks cover large geographic areas and, therefore, are less detailed representations of real world highway and transit facilities and services. Paths are determined based on weighted travel-time cost. For highway assignment, an equilibrium concept is used to route vehicles between their origins and destinations. Typically for transit assignment the shortest path through the network (based on the perceived travel-time cost which is a weighted combination of in-vehicle, out-of-vehicle time, and cost elements) is taken.

### D.1.5 Calibration

The model set is calibrated for a base year data set. The base year data set is linked to survey data which captures the travel characteristics of the modeled region. The MWCOG model set is calibrated to the 1994 home travel survey. A new household survey is being conducted through 2008 and will serve to update MWCOG's models in the future.

## *D.2 Validation of the Tool for the Study*

Version 2.1D#50 of the MWCOG model has been validated to year 2000 travel data. The calibration and validation are on a regional basis. For this study, we focused on the jurisdictions in our study area and reviewed the validation.

Commuters, and associated carpool and transit users, are important users of the proposed directional HOT facilities. Thus, validation has focused on work trips. The HBW trips represent the longer-distance trips and also the trips most likely to use shared ride or to be impacted by TDM measures. For validation, we compared the model results for year 2000 to the Census Transportation Planning Package (CTPP) data. The CTPP data was at the jurisdictional level and refined/factored by MWCOG based on other survey data for the year 2000.

For total motorized person trips in our study jurisdictions, the model estimated trips were 2.5 percent greater than the CTPP data. The total work trips in the study jurisdictions were 471,639 trips per day. For work trips originating in the study area jurisdictions and going to Washington, D.C., Arlington, Alexandria, or Fairfax, the model estimated mode share was 32 percent on transit modes and the observed transit mode share was 27 percent transit. The transit mode share was 23 percent higher than the observed mode share for year 2000.

The year 2000 vehicle-miles traveled (VMT) for the study corridor jurisdictions was six percent higher than the observed VMT. The model estimated average weekday VMT was 15,707,000 miles. The observed average weekday VMT was 14,779,000 miles. The VMT is representative

of all travel and not just HBW. It represents all trip purposes, as well as external travel into and out of the region.

The results of the 2000 model validation for the study area jurisdictions show that the model set reasonably represents the travel in the corridor within expected levels of accuracy.

## *D.3 Origin-Destination Maps*

A series of summary origin-destination mode choice results maps are on the pages which follow. These maps depict the origin and destination flows of work trips for the morning peak period from major travel markets to major travel markets in the study area and the associated mode choice for the following scenarios and horizon years: 2015 Refined Alternative; 2015 BRAC; 2030 Baseline; and 2030 Refined Alternative.

# Appendix E

# Appendix E – Detailed TDM Model Input Assumptions

This Appendix describes the assumptions used in estimating the impacts of the TDM strategies included in the low, medium, and high alternatives. The FHWA TDM Model was a primary tool to estimate strategy impacts. This Appendix presents the modeling assumptions and settings used for strategies analyzed using the model.

The Appendix also presents the assumptions applied for strategies that could not easily be analyzed by the TDM Model. Trip reduction impacts for these strategies were estimated through "off-model" calculations, using available data from the Washington metropolitan area or other regions if local data were not available. These data sources and calculations are summarized below.

Tables E-1 through E-3, which follow these individual assumption descriptions, list the strategies included in the low-, medium-, and high-service packages.

## *E.1 Strategies Analyzed with TDM Model*

Six strategies were modeled using the TDM Model. All of these strategies offered a financial incentive that could be translated into a daily cost saving per vehicle. These per vehicle savings were used as primary model inputs. The calculation of the assumed per vehicle cost savings for these strategies are described below:

- Capital Assistance for Vanpools;
- Capital Cost of Contracting for Vanpools;
- Carpool Incentives;
- Vanpool Driver Incentives;
- Vanpool Insurance; and
- VanStart/VanSave.

### Capital Assistance for Vanpools

This strategy is similar to the Capital Cost of Contracting in that it also would provide a cost saving for lease/purchase of vans. The difference in this strategy is that it would apply to both new and existing vans. DRPT assumes this strategy would provide a subsidy of about $1,000 per van per year. That level of subsidy would equate to about $4 per day per van ($1,000/ 250 work days = $4).

### Capital Cost of Contracting for Vanpools

Vanpools pay a capital cost to buy or lease van vehicles. This strategy would provide an incentive to defray part of the capital cost. The budget for this strategy is $5 million over 20 years, or about $250,000 per year.

DRPT estimates a typical monthly capital cost of about $700 per van and assumed that the subsidy would cover no more than 35 percent of the capital cost, or about $3,000 annual subsidy per van ($700/month x 12 months x 35 percent = $3,000). On a daily basis, this subsidy would equal about $12 ($3,000/250 work days = $12).

## Carpool Incentives

The Carpool Incentive program would offer carpoolers a financial benefit for each rideshare use.

The budget for this program is $3 million over 20 years or $150,000 per year. The analysis assumed the budget for this program would provide an additional $10 per month ($120 per year) subsidy for up to 1,250 participants ($150,000/1,250 carpoolers = $120 per year). This would equal about $0.50 per day subsidy for each carpooler ($120/250 work days). Because the TDM Model requires that subsidies be entered as "per vehicle" amounts, the model inputs would be $1 per day for two-person carpools, $1.50 per day for three-person carpools, and $2 per day for four-person carpools.

## Vanpool Driver Incentives

The Vanpool Driver Incentive also represented a vanpool cost-saving. In this case, the incentive was provided only to the driver, thus riders would not necessarily receive a financial benefit from this strategy. But because driver recruitment is a large part of van start-up, it was assumed that the incentive was distributed to all vanpool members and the model input was defined as a daily travel cost reduction for vanpooling.

The 20-year budget for this strategy was $250,000 or about $12,500 per year ($250,000/ 20 years = $12,500). Assuming about 45 to 50 new vans are formed/saved per year, as estimated by DRPT for the VanStart/VanSave program, this subsidy would equal about $250 per driver/van ($12,500/50 vans = $250). If averaged over a year, this strategy would provide a cost saving of about $1 per day ($250/250 work days = $1 per day) to the van.

The budget allocated to this strategy would increase in the medium and high Program Alternatives, but the daily subsidy is assumed to be the same in these alternatives. The additional budget would allow more vans/drivers to receive the incentive.

## Vanpool Insurance

The Vanpool Insurance strategy would provide a pool to "buy-down" for vanpools for the annual cost of vehicle insurance. The 20-year budget for this strategy is $1,500,000 for the low program. This budget would be in addition to initial insurance pool funding of $500,000 that is included in the TDM baseline.

DRPT estimates the annual insurance cost per van to be about $2,000 and estimates the baseline $500,000 will enable vans to receive 10 to percent saving in insurance cost. The additional funding of $1,500,000 in the low program, for a total of $2,000,000, would thus be expected to generate a 35 percent saving, equal to about $700 per year per van ($2,000 x 35 percent = $700). This subsidy would equal a per day subsidy of about $2.80 per van ($700/250 work days = $2.80).

The budget allocated to this strategy would increase in the medium and high program alternatives, but the daily subsidy is assumed to be the same in these alternatives. The additional budget would allow more vans to receive the incentive.

## VanStart/VanSave

The VanStart/VanSave program offers temporary financial benefits for new vanpools (start-up period) and empty seat incentive for existing vanpools that lose a rider. This strategy was defined as an estimated daily travel cost reduction for vanpooling.

A $1.3 million budget was allocated for this strategy, for 20 years for the low program. Thus, the annual budget for this strategy was assumed to be about $65,000 ($1,300,000/20 years = $65,000).

DRPT estimated the budget would cover funding for 43 vans per year, with about one-half of the funding for new vans and the remaining half used to maintain existing vans that lost a rider. The share apportioned to new vans would provide a start-up subsidy of about $1,500 per van for about 22 new vans per year ($65,000 x 50 percent start-up/22 vans = $1,500 per van).

The subsidy would be offered for a start-up period of only three months, but the TDM model assumes only ongoing subsidies. Thus, for analysis purposes this subsidy was averaged over six months to approximate the value of an ongoing incentive. At 125 work days over six months, the vanpool would realize a daily subsidy of $12 ($1,500/125 work days = $12).

The budget for this strategy was the same in all three program levels: low; medium; and high, so the model input calculated above was used in model runs for all three levels.

## *E.2 Strategies Analyzed Off-Model*

Four TDM strategies could not be modeled using the TDM Model, thus were analyzed "off-model," using data on impacts of similar programs implemented in the greater Washington metropolitan region. In all cases, these local results were obtained from the regional analysis of Transportation Emission Reduction Measures (TERM) conducted by the Metropolitan Washington Council of Governments' Commuter Connections program. These strategies included:

- Enhanced Guaranteed Ride Home Program;
- Rideshare Operations Support;
- TDM Program Marketing; and
- Telework Program Assistance.

### Enhanced Guaranteed Ride Home Program

A Guaranteed Ride Home (GRH) Program offers free transportation home to commuters who do not drive alone to work and have a personal emergency during the work day. A region GRH program currently is operated by Commuter Connections for commuters who work in the Washington metropolitan region. The Enhanced GRH program would expand the coverage of the GRH, program to additional commuters who now use I-95/I-395 but who currently are not involved in the Commuter Connections' program.

Commuter Connections' 2005 TERM analysis estimated a reduction of about 0.3 percent of total vehicle trips and VMT regionwide from regional GRH on a base of 3.4 million daily vehicle trips. For the I-95/I-395 analysis, a trip reduction of 0.1 percent was assumed, to avoid overlap with MWCOG's program, which serves nearly all of the study area. Additionally, the reduction was applied only to commuters who live in the southern portion of the study area.

### Rideshare Program Operational Support

The Rideshare Program Operational Support strategy would primarily fund resources for additional rideshare staff to assist commuters with trip planning and information requests.

The estimated impacts of this strategy were assumed to be similar to impacts realized for ride-share support services implemented by the Commuter Connections program in the Washington metropolitan region.

The MWCOG 2005 TERM analysis estimated about 0.2 percent of total vehicle trips and VMT regionwide from rideshare support (separate from other strategies such as GRH and marketing). For the I-95/I-395 analysis, a reduction of 0.1 percent of trips is assumed, with the reduction applied to a limited area; DRPT assumed the additional staff would be assigned to programs in the southern portion of the study area.

## TDM Program Marketing

The TDM Program Marketing strategy would encompass outreach and marketing campaigns to acquaint commuters with nonSOV options available in the I-95/I-395 corridor. To estimate trip reduction for TDM marketing, the analysis examined trip reduction results calculated for a regionwide TDM marketing campaign implemented by Commuter Connections program in the Washington metropolitan region.

In 2005, using data from the 2004 regional State of Commute survey, Commuter Connections estimated the percentage of regional commuters who shifted from driving alone to a nonSOV mode after hearing or seeing commute marketing. The 2005 TERM analysis estimated a reduction of about 0.2 percent of total vehicle trips and vehicle miles of travel (VMT) regionwide from mass marketing ad campaigns on a base of 3.4 million daily vehicle trips.

This percentage was used as a starting point for estimating trip reduction from a campaign targeted to the I-95/I-395 corridor. For the I-95/I-395 analysis, a reduction of 0.1 percent of trips was assumed with the adjustment made to account for dissimilarities between the MWCOG survey area and the I-95/I-395 study area and for overlap with existing ads/marketing conducted by Commuter Connections in the northern section of the corridor.

The assumed reduction also was applied primarily to the southern areas of the study area. Because some marketing of this type currently is implemented in the northern sections of the study corridor, the primary emphasis of the outreach was assumed to be targeted to commuters who lived in the southern areas.

## Telework Program Assistance

The estimated impacts of this strategy were calculated using data from the 2007 regional State of the Commute (SOC) survey conducted by Commuter Connections. This survey included questions on current use of telework and potential use of telework among nontelework commuters.

The SOC survey showed that about 21 percent of Northern Virginia workers teleworked an average of 1.6 days/week. To identify commuters who could be potential teleworkers, the survey asked respondents if their job responsibilities would permit work away from their main work location and if they would want to telework if given the opportunity.

The survey showed that about 27 percent of office-based commuters and 10 percent of nonoffice commuters in Northern Virginia were potential teleworkers. This assumed, however, that their employers would allow them to telework. This was thought to be too aggressive an assumption for the I-95/I-395 analysis, thus a lower percentage of likely new teleworkers was assumed.

For the 2015 time horizon, an additional eight percent of office-based commuters and two percent of nonoffice commuters were assumed to telework. Over the Northern Virginia survey area, this office/nonoffice mix equated to about seven percent of all nonteleworking commuters. The SOC

survey indicated that potential teleworkers were likely to telework less frequently than current teleworkers; the "anticipated frequency" reported by these commuters was estimated to be about 0.9 days/week.

When factored together to estimate a percentage of trips reduced, this equaled approximately 1.2 percent of daily person trips removed (7 percent x 0.9 TW days/5 days/week). Because teleworkers are distributed across all travel modes on nontelework days, this reduction was applied to both SOV and nonSOV trips.

## Table E-1. TDM Analysis Low-Program Elements

| Program Elements | Analysis Assumption | Modeling Strategy |
|---|---|---|
| Carpool Incentives | Assume the program offers additional $10 per month subsidy per person (funding for 1,250 users). | $0.50/day/person subsidy. |
| Rideshare Program Operational Support | The MWCOG 2005 TERM analysis estimated about 0.2 percent of total vehicle trips and VMT regionwide from rideshare support (separate from other strategies). For this analysis, a reduction of 0.1 percent of trips is assumed, applied the reduction to a limited area, to reduce overlap with ad/marketing in the MWCOG area. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| TDM Programs Marketing | MWCOG's 2005 TERM analysis estimated a reduction of about 0.2 percent of total vehicle trips and vehicle miles of travel (VMT) regionwide from mass marketing ad campaigns on a base of 3.4 million daily vehicle trips. For this analysis, a reduction of 0.1 percent of trips is assumed. The reduction is applied to a limited subsection of the study area, to account for potential overlap with ad/marketing in the MWCOG area in the northern section of the corridor. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| Vanpool Driver Incentives | Assuming about 45 to 50 new vans are formed/saved per year, as estimated by DRPT for the VanStart/VanSave program, this subsidy would be about $250 per driver. If it is averaged over a year, it would be about $1 per day. | $1/vehicle subsidy. |
| Vanpool Insurance | DRPT estimates the insurance cost per year at about $2,000 per van and estimates the $500,000 they are including in the baseline would enable a 10 to 15 percent saving. With this additional funding, a 35 percent saving ($700 per year) is assumed, which would be would equal about $2.80 per day per van. | $2.80/day/vehicle subsidy. |
| VanStart/VanSave | DRPT estimated the $1.3 million budget would cover funding for 43 vans per year, but about one-half would be for existing vans, so the subsidy would be about $1,500 per van for about 22 new vans. The subsidy would be start-up only (three months), but for analysis this subsidy is averaged over six months to approximate an ongoing incentive. At 125 work days over six months, the daily subsidy would be $12 for the van. | $12/vehicle subsidy. |

## Table E-2. TDM Analysis Medium Program Elements

| Program Elements | Analysis Assumption | Modeling Strategy |
|---|---|---|
| Capital Cost of Contracting for Vanpools | DRPT estimates a typical monthly capital cost of about $700 per van or about $32.00 per day. DRPT does not expect the subsidy to be 35 to 40 percent of that figure, so a $12 per day per van is assumed. | $12/vehicle subsidy. |
| Carpool Incentives | Same assumptions as the low alternative. | $0.50/day/person subsidy. |
| Rideshare Program Operational Support | Same assumptions as the low alternative, but with more money applied. A trip reduction factor of 0.15 percent is assumed for the medium alternative. | Reduce vehicle trips originating in southern districts by 0.15 percent. |
| TDM Programs Marketing | Same assumptions as the low alternative. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| Telework Program Assistance | According to the 2007 State of the Commute (SOC) survey for the MWCOG region, about 21 percent of Northern Virginia workers telework (TW) today, an average of 1.6 days/week. The potential for additional TW (TW-appropriate jobs and want to TW) appears to be about 27 percent of office-based commuters and 10 percent of nonoffice commuters. But this assumes employers allow them to TW, which is too aggressive. Because 2015 is the time horizon, an additional eight percent of office-based commuters TW and two percent of nonoffice commuters is assumed. The "anticipated frequency" reported by these commuters is estimated to be about 0.9 days/week. This is equal to approximately 1.2 percent of person trips removed (7 percent x 0.9/5 days/week). | Reduce person trips by 0.12 percent. |
| Vanpool Driver Incentives | Same assumptions as the low alternative. | $1/vehicle subsidy. |
| Vanpool Insurance | Same assumptions as the low alternative. | $2.80/day/vehicle subsidy. |
| VanStart/VanSave | Same assumptions as the low alternative. | $12/vehicle subsidy. |

## Table E-3. TDM Analysis High Program Elements

| Program Elements | Analysis Assumption | Modeling Strategy |
|---|---|---|
| Capital Assistance For Vanpools | DRPT assumes about $1,000 per van per year. That level of subsidy would be about $4 per day per van. | $4/vehicle subsidy. |
| Capital Cost of Contracting for Vanpools | Same assumptions as the medium alternative. | $12/vehicle subsidy. |
| Carpool Incentives | Same assumptions as the low alternative. | $0.50/day/person subsidy. |
| Enhanced Guaranteed Ride Home Program | MWCOG's 2005 TERM analysis estimated a reduction of about 0.3 percent of total vehicle trips and VMT regionwide from regional guaranteed ride home on a base of 3.4 million daily vehicle trips. For this analysis, a trip reduction of 0.1 percent is assumed, to avoid overlap with MWCOG's program, which serves nearly all of the study area. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| Rideshare Program Operational Support | Same assumptions as the low alternative, but with more money applied. A trip reduction factor of 0.15 percent is assumed for the medium alternative. | Reduce vehicle trips originating in southern districts by 0.15 percent. |
| TDM Programs Marketing | Same assumptions as the low alternative. | Reduce vehicle trips originating in southern districts by 0.1 percent. |
| Telework Program Assistance | Same assumptions as the medium alternative. | Reduce person trips by 0.12 percent. |
| Vanpool Driver Incentives | Same assumptions as the low alternative. | $1/vehicle subsidy. |
| Vanpool Insurance | Same assumptions as the low alternative. | $2.80/day/vehicle subsidy. |
| VanStart/VanSave | Same assumptions as the low alternative. | $12/vehicle subsidy. |